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Development in Scientific Methods

THIS generation has seen a remarkable vogue for books of reminiscences. It may be because the older folk like to remember the days of their youth, and how "the world went very well then." It may be because youth wishes to know what manner of men they were who appear to have built the industrialised and restless world in which they now live. We suspect, however, that these books appeal to the generation that is passing rather than to the generation that is coming. That is a pity, because youth does not know the conditions under which the pioneers worked. A striking example of this occurred in a recent presidential address when the speaker maintained that all the really important advances made in his quite old-established industry had arisen during the past few years, ignoring the foundation work of those who had gone before.

It was with considerable interest, therefore, that we heard the Norman Lockyer Lecture delivered on November 12 by Lord Rutherford, before an audience composed largely of a curious mixture of eminent men of science and students. Lord Rutherford took for his subject "Science in Development," and in so doing devoted the greater part of his lecture to a comparison between laboratory facilities of 40 years ago and now. The reaction of the students in our immediate vicinity as Lord Rutherford described the apparatus and methods in use at the Cavendish laboratory in 1895 was one of unrestrained mirth. The absence of many of the commonplace instruments of to-day and the "home-made" character of others appeared to strike many of his hearers forcibly, and physicists in particular were clearly amused by the makeshifts needed to obtain, for example, even the semblance of a steady electrical current in those days, and of the impossibility of measuring the voltage of the current without drawing so much from the cells that their potential fell rapidly.

The change that has taken place in the range and reliability of scientific instruments is all to the good and must have accounted in some degree for the striking acceleration in the speed of scientific development. As we listened to this lecture, however, we wondered whether any one of the students, or indeed, many of their teachers, realise that the primitive conditions of the Cavendish laboratory have their counterpart in many, if not in most, of our smaller industrial laboratories to-day. That statement must not be taken too literally, of course, but those who have worked in laboratories owned by firms not overburdened with capital, or by firms that do not regard chemistry and physics as being among their more important activities, know only too well that the purchase of expensive apparatus is impossible and that the chemist has often to make shift with home-made apparatus and must use his inventive capacity to overcome deficiencies in equipment. Students should be taught how to use the latest apparatus, but let us not "spoon-feed" them so that they are unable to work under the proverbial "cellar" conditions.

The scale on which scientific work is now conducted has been enlarged beyond all conception within the period covered by Lord Rutherford's review, and, if we have uttered a warning to chemists and physicists that in industry they must sometimes be prepared to do first-class work with apparatus considerably inferior in equipment to that of the Cavendish laboratory, it is also necessary to warn employers that they cannot get the best return from their laboratory expenditure unless they see to it that all reasonably essential apparatus is provided. To hold the scales between the two extremes it is necessary that there shall be on the board someone who can appreciate both the necessity for equipment and the possibilities of improvisation when expensive instruments may not be essential. The difference in scale between 1895 and now is not only in the greater volume of work carried out to-day; it is also a difference of size. Some of the experiments at the Cavendish laboratory and other places on transmutation have required elaborate apparatus almost on the engineering scale, such as the million-volt generator, and the very large electromagnets (weighing perhaps 50 tons) used for multiple acceleration of charged particles in the apparatus known as the cyclotron in the University of California. Work on low temperatures requires an elaborate engineering plant to produce high vacua and for the liquefaction of gases. Compare to-day's electrical equipment with that of the year 1895. There was in many laboratories even no lead accumulator and the experimenter had to rely upon primary batteries. Lord Rutherford himself in 1893 had to prepare each morning a battery of a dozen Grove cells, an operation which involved the cleaning and amalgamation of the zinc plates and adding the necessary acids. After a few hours work the battery showed signs of exhaustion and work had to cease for the day. A couple of years later, at the Cavendish laboratory, a better current was available, but the measuring instrument was such that the voltage used could not be determined for the reasons mentioned earlier. Lord Rutherford was in the habit of turning himself into a voltmeter by judging the strength of the current with his fingers, until one day he tried to do so when the conditions were damp! What a gap exists between 1895 and the million-volt generator of 1936!

Notes and Comments

Chemical Exports Still Falling

BRITISH overseas trade in October reached the highest figure since the depression. Not since November, 1930, had the total of exports been higher, and the total of imports was greater than since November, 1931. Most of the staple industries participated in the general improvement, but chemicals, drugs, dyes and colours were again among those which failed to share in the revival. A decrease of £159,987 in chemical exports for the month brought the total decrease for the ten months of 1936, compared with the corresponding period of 1935, up to more than a quarter of a million (£255,111). Chemical imports in October were £125,570 less than in October, 1935, but there has been an aggregate increase of well over three-quarters of a million (£824,889) in imports during the ten months. Exports of chemical products to Germany and the United States for the ten months revealed substantial increases, but it must be remembered that we import from Germany nearly ten times as many chemicals (in value) as we export to Germany, and from the United States about twice as many as we send to the States. While British exports to the two countries rose by 8.5 and 4 per cent. respectively, our imports from them increased in the same period by 17.6 and 13.9 per cent. respectively. Dyestuffs and carbon blacks again showed the principal increases among imports, while the heaviest fall in exports was in sulphate of ammonia, which decreased by £239,330, or 18 per cent., during the ten months. Japan's purchases of that commodity fell from £28,539 to £1,003, Spain from £127,852 to £4,660, and Portugal from £129,815 to £34,676.

Air Raid Precautions

THE Air Raid Precautions Department has not yet solved the problem of protection from incendiary bombs, but the Stationery Office pamphlet on "Personal Protection Against Gas" (6d.) contains all that it is necessary to know on the subject of gas bombs, said Colonel W. Garforth in a talk to the Liverpool Section of the British Association of Chemists and kindred societies at Liverpool on November 13. The higher you went, he said, the safer you were from poison gas, and at a height of 30 feet from the ground the air was clear of gas; nevertheless, the Department was not satisfied with that figure and had asked for further particulars. Startling information was divulged concerning respirators. The service respirator as issued to the army, navy, air force and fire brigades would be made by the Government; the civilian duty respirator—"for the use of civil servants in responsible posts"—and the civilian respirator, for free issue to the general public, would be made by private firms approved by the Government. The cost of the civilian respirator was between 2s. and 3s., the civilian duty pattern from 10s. to 12s., and the service pattern about 20s. All of the respirators were claimed to be proof against all modern military poison gases. Worse gases were known in the laboratory, but they were not suitable for modern military purposes. The respirators of each pattern had been tested in a chamber containing one hundred times the concentration of gas likely to be met with under wartime conditions, but they varied in the length of time they could be used. The service respirator would last twenty-four hours, the civilian duty respirator three or four hours. The containers would resuscitate themselves if left to themselves, but would have only about 25 per cent. of their former efficiency. One wonders precisely how much adequate protection the general public will obtain from the particular respirators allocated to them and which cost so little!

No Fear of Chaos

IT is reassuring to learn from the general secretary of the Chemical Workers' Union that no state of choas as to wage and condition regulations in the chemical industry can possibly exist, and that the warnings of possible trouble which have been uttered recently can be disregarded. Commenting on the statement made by Mr. Ernest Bevin at a conference of Imperial Chemical Industries representatives and the Transport and General Workers' Union that the withdrawal of I.C.I. from the joint industrial council for the industry was likely to complicate matters, we referred last week to the satisfactory relations prevailing between employers and workpeople generally in the industry. The executive council of the Chemical Workers' Union met last week-end and expressed the definite opinion that the statements made at the conference were against all the known facts of the case. Whilst the union holds no brief for employers, it believes that the better and more progressive among them will concur in its view that there are no grounds for claiming that the chemical industry should be subject to special legislation or Government regulation as to negotiations on wages and conditions, from which other industries are free. Some 82 per cent. of Britain's chemical production and distribution is in the hands of 764 companies with plants in England and Scotland, and the records of the Chemical Workers' Union indicate that not less than 573 of the firms, employing 85 per cent. of the labour engaged in the industry, are operating wage and condition standards set up by the employers' organisations existing since 1918 in conjunction with the unions operating in the industry or on the basis of agreements existing between individual firms and separate unions acting alone.

Chemistry in Agriculture

ONE of the most interesting sections of the second report of the Agricultural Research Council deals with the attack upon the virus diseases of plants. Valuable work has been done, but much remains to be discovered about the fundamental nature of these invisible agents of disease and how they are transmitted. Recent research work has revealed a new lettuce which matures early and produces solid hearts during the short daylight of winter; a harmless process of greening, which reproduces the natural colour of the pea and has made possible the large development in the growing and canning of peas; and the tracing of a new fungus which caused some varieties of strawberries to fall to pieces while being canned. The Council expresses the hope that new scientific knowledge will be gained as a result of the many investigations now proceeding.

Manufacture of Sulphuric Acid

A Modern Lead Chamber Plant at King's Lynn

FOR over 45 years the Moritz Chemical Engineering Co., Ltd., have been endeavouring to perfect the plants used for the manufacture of sulphuric acid by the process of lead chambers. They have been able to produce, in lead chambers, sulphuric acid at a much lower cost price than that obtained so far either with tower systems or with intensive working apparatus or with contact plants. The cost of such a Moritz plant per ton of manufactured acid is much lower than that obtained with any other system and the installation requires less labour. In addition, the acid is very pure, very concentrated and the plant requires a reduced space. In their high chambers with low communications, the production of 53° Bé acid per cubic metre of chamber is easily brought up to 20 kg. per cubic metre of chamber, or to 22 kg. per square metre of radiating wall.

Several plants have been built on this principle, two of which have been in operation in Spain for over seven years. A new system, however, has been in operation for four months in England, at the works of the West Norfolk Farmers' Manure and Chemical Co-operative Co., Ltd., at King's Lynn. Here the results are even better than those which the Moritz Chemical Engineering Co. had guaranteed. Fig. 1 shows a plan and elevation of the whole of this plant.

For roasting the pyrites there are five Moritz furnaces, each taking 8 tons of pyrites per 24 hours. These furnaces are of the company's 1912 type with superposed floors. Fig. 2 shows, in elevation and in section, the arrangement of the various floors, and Fig. 4 shows the outside appearance of the furnaces, which were already working on the old acid system installed at King's Lynn, and have now been in use for over 20 years. The same furnaces are now built with from seven to twelve floors, burning one ton per floor, the pyrites being loaded in the centre of the upper first vault.

The pyrites loaded beforehand on trucks, of which the tare is known, is weighed and discharged at regular intervals into the feeding hopper of each furnace, from where they fall on to the drier before entering the furnace. The pyrites then go from floor to floor, pushed by air-cooled cast-iron raking arms and are discharged in the roasted condition through the lower part of the furnace when they contain no more than 1.00 to 1.5 per cent. of sulphur in addition to the fixed amount, according to nature.

The sulphur gases coming from the furnaces are collected in a main duct suitably insulated and arranged to be easily cleaned; they then pass through two Moritz electric dust precipitators, working in parallel. These precipitators are of the hexagonal tube type with central electrode. As will be seen from Fig. 5, they are in the form of a cylindrical vertical tower with a conical bottom, with the inside arrangement as shown in Fig. 3.

The gases entering the apparatus descend along the side and rise inside the tubes, where the dust is precipitated. The dust is collected in the cone at the base, from where it is removed from time to time through a trap-door. The inside arrangement is such that the apparatus has only a very low resistance to the passage of the gases and furthermore, the heat insulation applied against the steel casing avoids their cooling; thus the drop in temperature of the gases between the inlet and the oulet of the precipitator is only between 60° and 80° C., which makes it possible in most cases to concentrate at 66° the acid produced in the Glover tower, and in the concentrating canal preceding it, without any consumption of fuel and without loss of acid in the shape of " petites eaux."

The electric high tension current is produced in an electric cabin, carefully closed, where the direct current feeding the whole system is first transformed into alternating current at 300 volts, and is then raised up to 60,000 volts by means of a static transformer, and finally rectified into direct current by means of a mechanical rectifier.

By means of this electric precipitation, from 96 to 98 per cent. of the dust is removed from the gases which arrive in the Glover tower at a temperature of 525 to 550° C. All the sulphuric acid produced at the King's Lynn works is exclusively for the manufacture of superphosphate. In conse-

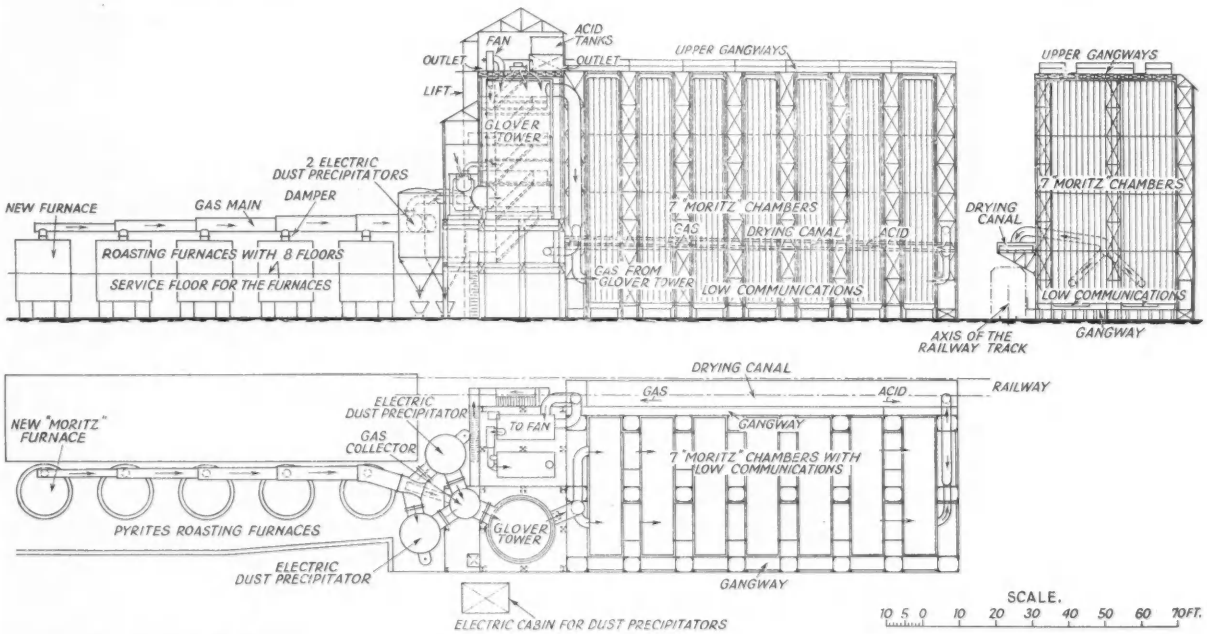


Fig. 1.—Plan showing the complete Rene Moritz System Sulphuric Acid Plant, as installed at the works of the West Norfolk Farmers' Manure & Chemical Co-operative Co., Ltd., at King's Lynn.

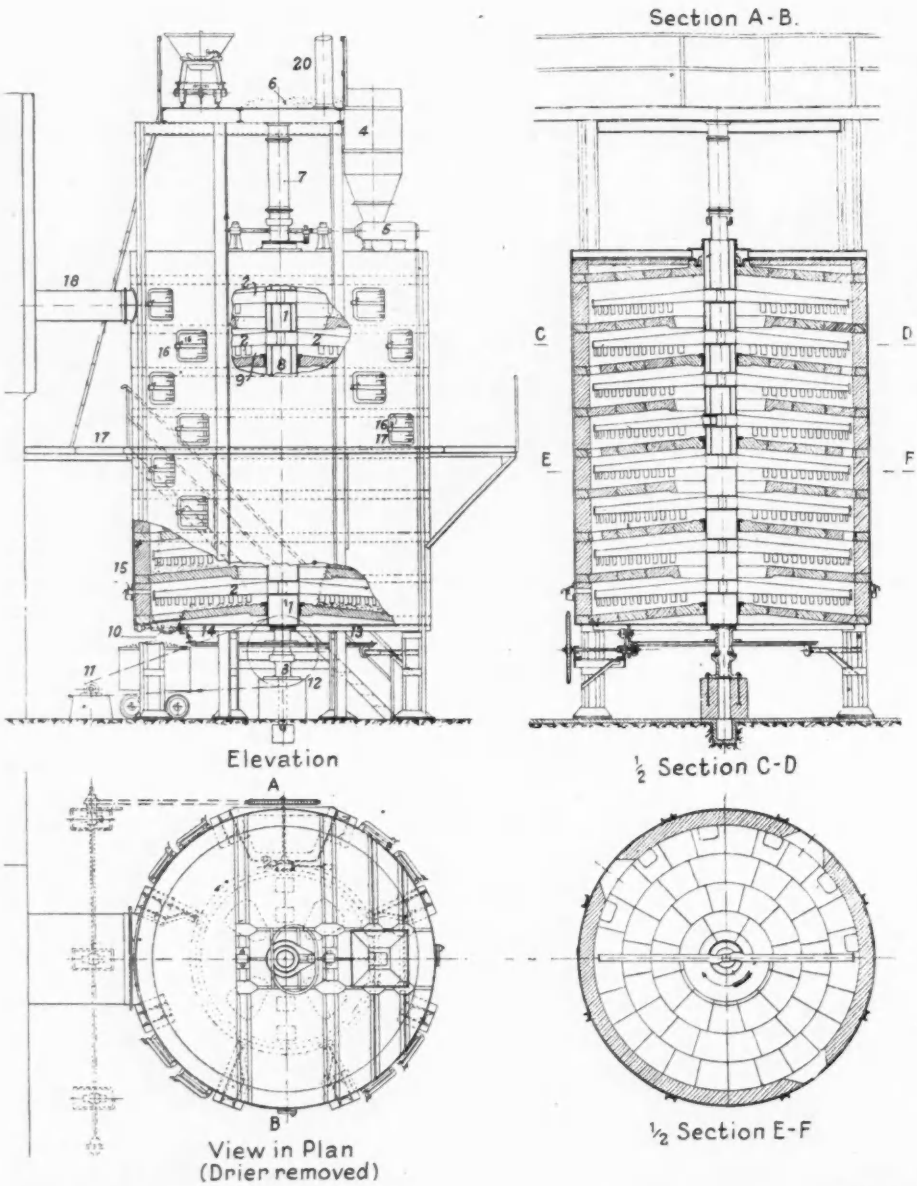


Fig. 2.—Elevation and section of Moritz Pyrites Roasting Furnaces, with 8 super-imposed floors and piston charger.

1.—Central shaft. 2.—Raking arms. 3.—Shaft pivot. 4.—Loading hopper. 5.—Charger. 6.—Drier for pyrites. 7.—Hot air to drier. 8.—Circulation of hot air. 9.—Circulation of cold air. 10.—Discharge trap. 11.—Transmission. 12.—Driving wheel. 13.—Driving disc. 14.—Trap control. 15.—Cold air inlet. 16.—Inspection door. 17.—Service gangways. 18.—Gas outlet. 19.—Cold air inlet. 20.—Air discharge.

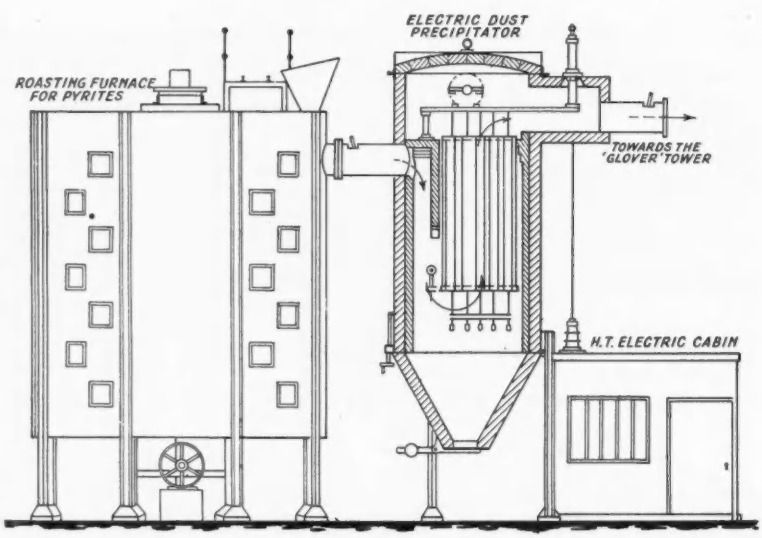
quence, plant for the concentration of the acid to 66° Bé, before the Glover tower, has not been installed.

The tower building, erected by Sir Lindsay Parkinson and Co., Ltd., is located between the furnace building and the structure supporting the lead chambers. It consists of two concrete floors, heavily reinforced, which carry the Glover and the Gay-Lussacs. Notwithstanding the dimensions required to carry the heavy loads of the towers, it has been possible to locate the coolers and the acid tanks on the floor under the towers, and thus avoid any loss of space. A steel construction has been used for the upper floors and this, together with the lead chamber structure, were supplied and erected by Dawnays, Ltd.

The Glover tower is of the Moritz round type, and of a large diameter in view of the high output required. It consists of a cylindrical tower, lead lined on its periphery, diameter 17 ft., height 40 ft., filled inside with special bricks which are resistant to the hot acids and are laid on an anti-acid lava grate. This arrangement facilitates the passage of the gases, whilst still allowing a very large surface of contact between the gases and the liquids which spray this tower very evenly.

The gases enter underneath the grate, through a large inclined connecting pipe and rise through the filling where they are divided and placed into intimate contact with the acid which is fed at the upper part by a circular distributor with compartments and distributing tanks (Fig. 6). This distributor, very simple and very effective, is fed at its centre by measuring tanks, each receiving the acid from the storage

Below—Fig. 3.—Section of Moritz Electrostatic Dust Precipitator.



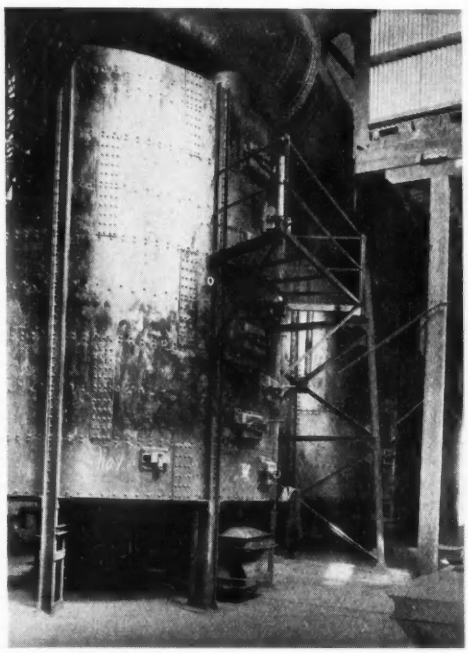


Fig. 4.—Outside view of the Pyrites Roasting Furnaces, built in 1912.

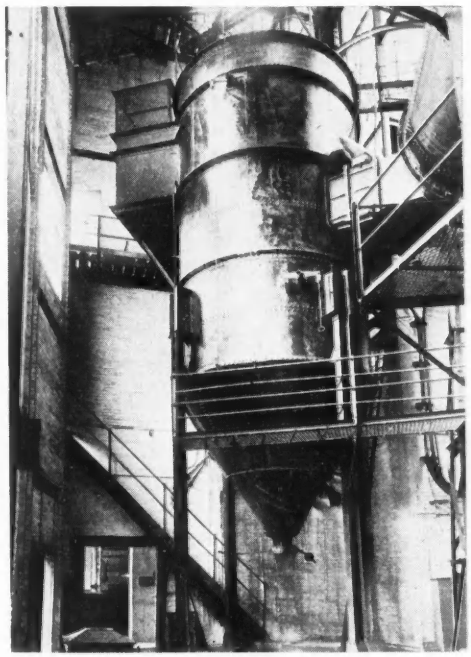


Fig. 5.—External view of Moritz Electrostatic Dust Precipitators.

tanks placed above. These measuring tanks are used for gauging exactly the amount of each kind of acid flowing on the Glover and on the Gay-Lussacs. At the base of the Glover tower the acid trough is cooled at its periphery by a water trough (Fig. 9).

The gases leaving through the upper part of the Glover go to the chambers. The hot acid leaving the base of the Glover goes to the mechanical coolers (Fig. 10). These coolers are of cylindrical shape, eight in number, 3 ft. 4 in. diameter and 4 ft. high. In the centre of each is a Moritz turbo-stirrer ensuring an active acid circulation around a lead coil of great length in which the water circulates. Very effective cooling is thus obtained. The coolers, moreover, are disposed in two rows of four, working in parallel, and the hot acid entering at a temperature of 130-140° C., leaves at only 25-35° C., according to the time of the year. The high degree of circulation obtained in these tanks prevents the adhesion to the cooling tubes of any matter which crystallises or separates during the cooling. The power consumption is small, being only 0.8 kWh per ton of acid manufactured, and the overall dimensions of the whole cooling plant for such a large production is only 14 ft. by 10 ft. 6 in.

The upkeep of the coolers is practically negligible; they have never to be cleaned. They are, moreover, disposed in cascade arrangement, one behind the other, and it is possible to let the acid flow directly over any one cooler without flowing into it if that cooler has to be stopped for an unforeseen reason.

Cold acid from the coolers flows into the circulation tanks located on the main floor of the plant. These tanks are used to ensure the circulation on the towers by means of pumps. Constructed in reinforced concrete, they are lined with a thick coating of lead and the circulation of acid on the towers of the system is secured by a set of three double piston

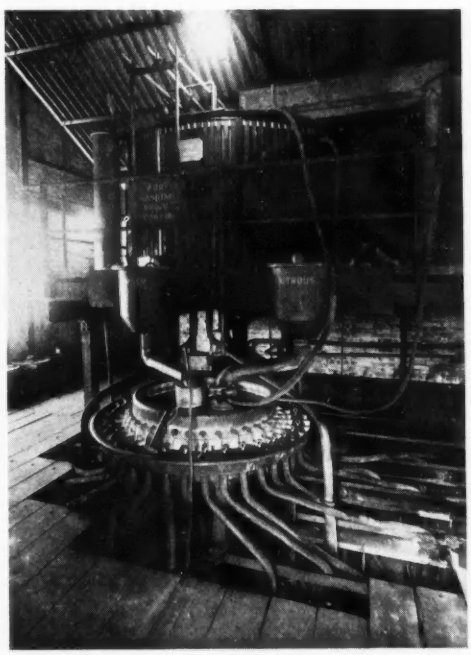


Fig. 6.—The Glover Tower (taken from above) showing the acid distribution and circulation tanks.

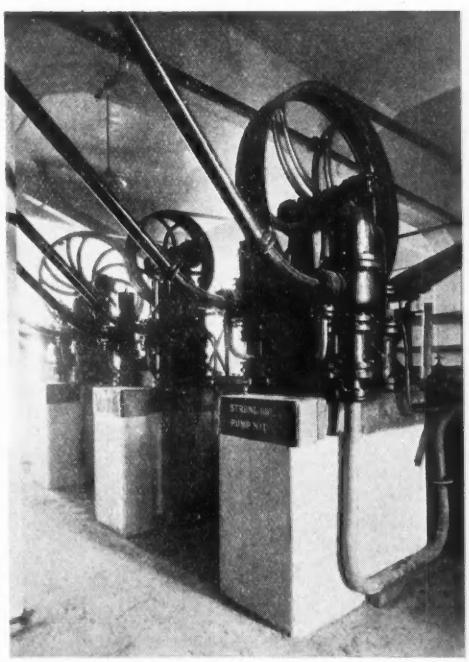


Fig. 7.—Kestner Pumps for acid circulation.

Kestner pumps (Fig. 7). The suction pipes of these pumps are made in tellurium lead, and the delivery pipes are steel tubes lined inside with lead. A motor-driven vertical centrifugal pump is used as a spare; it can be used for either the nitrous acid, the 60° Bé acid, or the chamber acid, and can be easily used in place of any one of the piston pumps if occasion arises.

The gases leaving the upper part of the Glover tower go into the lead chambers, which in the Moritz system are high chambers with patented low communications. All the lead (sheets or pipes) was supplied by The Cookson Lead and Antimony Co., Ltd., The chambers, seven in number, form a compact but well-aerated whole, and are placed one after the other, each chamber being 9 ft. in length, 37 ft. 6 in. in width, and 66 ft. in height. A strong steel structure, resting on a reinforced concrete slab beneath the chambers, is built on 28 pairs of piles. The steel structure carries the whole weight of the lead, using a method of continuous connections which has been adopted in the Moritz system for over 25 years and which is still the best as it avoids continuous repairs necessitated by separate connections. The Moritz system also increases considerably the cooling capacity of the chambers, making it possible to decrease their radiating surface by more than 10 per cent., the connections forming gills in a similar way to gilled pipes. These continuous connections, which make it possible to maintain the lead in a perfect condition, may be seen in Fig. 11.

Perfect Cooling for Chamber Walls

The metallic structure is disposed in such a way that it facilitates the air circulation, the result being that the cooling of the walls is perfect, and, thanks to large cooling areas, it has been possible to provide a gangway all around the chambers at a height of 3 ft. 4 in. from the ground. This gangway is used for the control of the plant in operation. The small braces which prevent the movement of the walls can also support a board and a small ladder, the only supports required by the plumber in making any repairs to the chambers, although such repairs occur very seldom.

At the base of each chamber is a steel trough lined inside with lead. These troughs are placed 2 ft. 6 in. from the ground, and so allow a free circulation of the air underneath and along the walls between the consecutive chambers. Communication from chamber to chamber is assured by the patented low communications.

Due to the accurate design of the Moritz lead chambers it is possible to obtain a ratio of nearly 1 between the wall surface and the volume of chamber, the result being that a production of 20 kg. per cubic metre is easily obtainable without any so-called intensive working, as the nitric consumption is between 0.8 and 0.9 kg. of nitric acid at 36° Bé in relation to the monohydrate, whereas with the so-called "intensive" system of working the nitric consumption is 1.5 to 2.2 per cent.

Chambers with Low Communications

With the patented design of the low communications the gases rise in the centre of the chambers and descend along the walls, but this movement occurs in a turbulent way which continually places the rising gases in contact with the descending gases at all successive levels. The reaction is thereby considerably increased, resulting in an excellent utilisation of the nitric which provokes a much larger number of reactions per cubic metre of chamber, but, thanks to the nearness of the outside walls, the heat is at once eliminated and so avoids excessive partial temperatures which are responsible for the high consumption of nitric acid per unit of production. On the other hand, when passing through the low communications the still sulphurous gases come into contact with the too highly condensed nitrous acid of the trough on a large surface, which makes possible a very rational utilisation of the nitrous products and a very thorough denitrification of the manufactured acid which leaves the chambers at the head of the system.

The dimensions adopted for the length of the chambers make it possible to easily atomise the water under pressure without fear of washing the walls. The atomisers regularly spaced across the width of each chamber are adjusted in such a way that the specific gravity of the acid produced in each chamber, as checked at the control points (Fig. 11), should be at the correct value, which varies generally (according to the chambers and the wishes of the manufacturer) from 51.5° to 48° Bé, corresponding in the trough to a concentration of 53° to 54° Bé. for acid leaving the chamber. Each chamber is provided with a control board at each end of the width, also shown in Fig. 11.

The regularity of these high chambers with low communications is so great that it astonishes those accustomed to large chambers. This regularity is due to continuous inter-exchange of heat from the sulphurous gas, the nitric and the water between the ascending and descending veins, working constantly in turbulence, according to the physical theory and to the internal production of calories as and when the reaction progresses. These inter-exchanges explain that the gases which leave the chamber are the most spent in reaction-potential for each particular chamber and one understands thus the great regularity of manufacture.

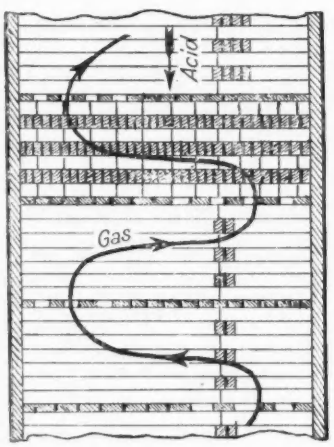


Fig. 8.—Section of a Moritz Gay-Lussac, with semi-permeable parts.

The gases leaving the last chamber at the level of the acid in the trough go into a drying canal running alongside the whole length of the seven chambers. This canal is slightly slanted. It is provided with regularly spaced dams which force the acid to flow in cascade and so ensures the renewing of the surface of contact between the acid and the gases, the latter circulating in the opposite direction. The drying canal also makes it possible to remove the last traces of moisture entrained by the gases. It cools the gases and, in addition, the nitrous acid which forms in this canal and which is discharged into the trough of the last chamber, so making it possible to keep the last chamber always nitrous, even in the case of a sudden large amount of sulphurous products arriving with the gases on account of any temporary error in the conduct of the plant.

The dried and cooled gases go to the Gay-Lussacs, which, in the King's Lynn plant, consist of two towers of rectangular section measuring 55 ft. in height and 7 ft. by 16 ft. 6 in. cross section. These towers are carried by framework in steel sections to which the lead is strongly bolted and the whole inside, according to the Moritz system, is filled with semi-permeable partitions which force the gases to follow a way which is considerably longer than the direct height of the towers (Fig. 8). It will therefore be seen that the capacity of the Gay-Lussac is fully used; this explains the very high efficiency of these towers which help to obtain the low nitric acid consumption of the plant.

Each Gay-Lussac is sprayed by means of a rectangular distributor with multiple alveoles, similar to the Glover distributor, as shown in Fig. 12. The flow of acid in each Gay-Lussac is carefully controlled by measuring tanks placed above the towers on the acid path.

The draught fan is located between the two Gay-Lussacs. This fan, constructed in lead, with a suction pipe of 32 inches, is driven by a motor through V-belts; the speed of the motor

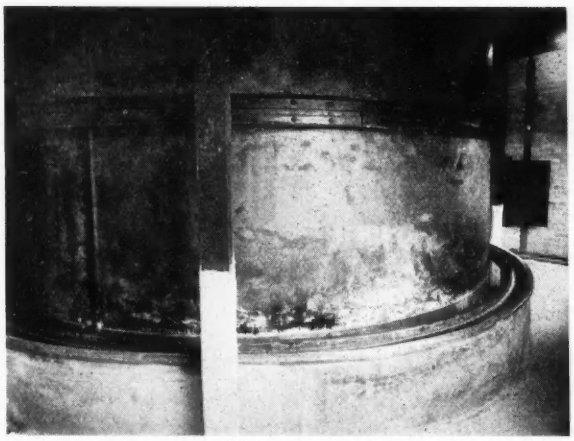


Fig. 9.—Water and acid troughs at the periphery of the base of the Glover Tower.

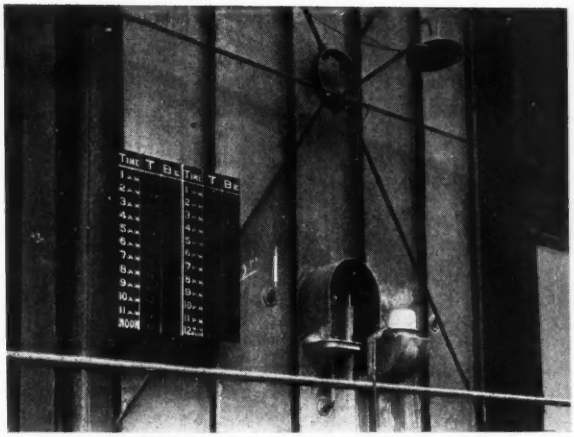


Fig. 11.—Outside view of Lead Chamber, showing the arrangement for controlling its operation.

can be varied, making it possible to adjust the draught of the plant according to the amount of pyrites burnt.

The gases leaving the last Gay-Lussac are discharged to the atmosphere through a chimney. Analyses made have always given less than 1 grain per cubic foot of gas, whereas the British Alkali, etc., Works Regulations allow 4 grains per cubic foot.

At King's Lynn the nitric acid feed is ensured by an ammonia oxidation plant, using an ammonia solution at 25 per cent. A boiler produces the regular distillation of the ammonia, controlled from a distributing board (to be seen in Fig. 13) and adjustable in volume. The gaseous ammonia is issued with the air in proportion of one volume of ammonia to nine volumes of air as an average and passes through a filter, visible at the front of Fig. 13. This gaseous mixture is freed from any trace of dust which it might contain and is delivered in the catalytic apparatus, system Moritz (also seen in Fig. 13), just behind the filter. This apparatus consists of a heat exchanger placed in its lower part, which is used to heat the gaseous mixture going on the catalytic cloth, and thus maintained automatically at the working temperature.

The hot nitrous gases coming from the oxidation plant pass through the tubes of the heat exchanger and are discharged into the sulphurous gases through a damper, and the piping is arranged in such a way that it is possible to deliver these nitrous gases either in front of the Glover tower or between the Glover tower and the first chamber. In fact, it has been found that on the starting of a sulphuric acid plant it is much more preferable to introduce the nitrous gases before the Glover tower. But, even in normally introducing the nitrous gases before the Glover, the sulphuric acid (at 60 to 60.5° Bé) flowing at the bottom of the Glover is entirely denitrified and the consumption of nitric is sometimes slightly increased, and it is for that reason that, once the Glover is hot, it is desirable to often feed the nitric between the Glover and the first chamber, whilst taking the necessary precaution

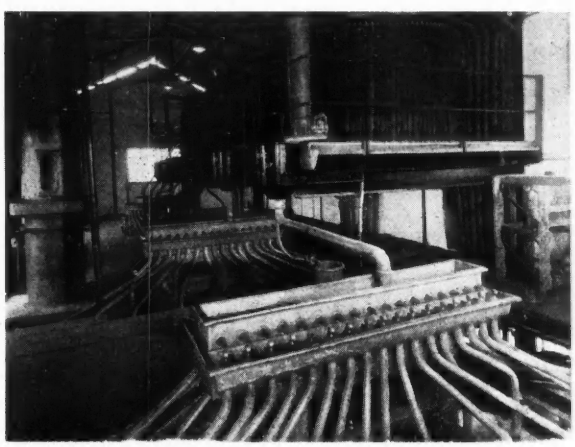


Fig. 12.—Acid Distributors for Gay-Lussacs; draught chimney seen to left.

to ensure that no condensation of nitric acid takes place as this would corrode the lead pipes.

A controlling device, consisting of a washing bottle and an aspirator, is used to check the percentage of ammonia in the mixture of ammonia and gas sent to the filter placed before the catalyser. A valve on the air circuit placed before

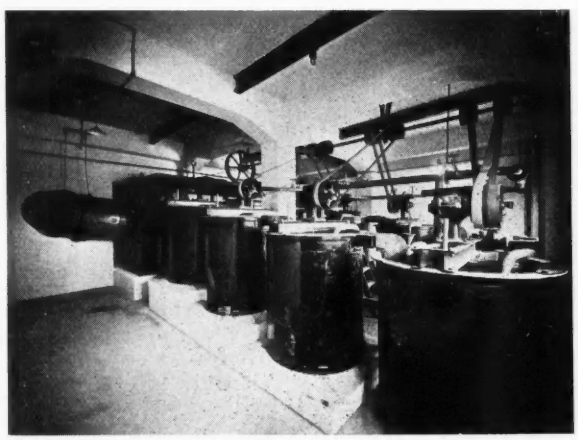


Fig. 10.—Moritz Mechanical Coolers and Draught Fan.

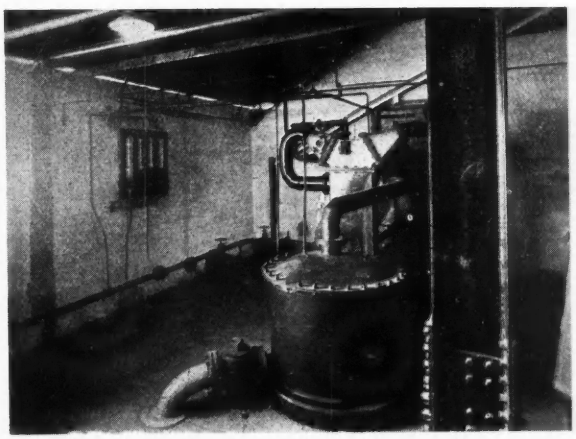


Fig. 13.—The Ammonia Oxidation Plant.

the controlling board makes it possible to maintain, or to change when required, the amount of air introduced in the mixture. The air compressor used was supplied by Air Pumps, Ltd.

The service of the whole plant is made by a single man who attends to all the chambers and to the towers. A lift, supplied by Marryat and Scott, Ltd., facilitates access to the different floors of the building, of the Glover tower and of the two Gay-Lussacs, of the coolers, ammonia oxidation plant, and of the pumps on the ground floor. Supervision is very easy and the cost price of the acid manufactured is extremely low. The power consumption is about 500 kWh per day, when burning 40 tons of pyrites. The electric precipitation of the dust ensures the production of clear acid and avoids absolutely the choking up of the Glover and Gay-Lussac towers. Notwithstanding the large production of the plant, the space occupied by the chambers and the towers in plan is only 135 ft. by 47 ft.

Letters to the Editor

Structure of Benzene and of Water

SIR,—To judge from his letter in your issue of October 17, Sir William Pope is evidently in better health. His sense of humour is returning to him—hence his advocacy of my "centric" formula of benzene, which has so long been the gibe of the unimaginative. I may say that my entry into the laboratory was slightly in advance of that of the Kekulé hypothesis.

Fortunately, Sir William is one of the few who remain chemists, notwithstanding the remarkable breadth of his knowledge. Most have taken to a physical abstraction only nominally chemical, which to me, at least, is without chemical feeling.

The story of the centric formula is an amazing one, illustrating the careless inconsequence with which writers now treat their subject. I usually turn the other cheek—having learnt to "wait and see"; still, I must confess that when I saw a long list of benzene symbols at the head of the big bundle of confused statement set out in the Chemical Society's Journal recently, my own last on the list but labelled Baeyer, I was roused to send a protest to the Editor.

Sir William Pope is right, I am sure, in assuming that Baeyer simply ab-and ad-sorbed *my formula*. I have always held that we only understand the things we do ourselves. Baeyer had no sooner assumed the formula than he cast it behind him, with contempt, too. Somewhere, however, in *Liebig's Annalen*, I believe in one of Bamberger's papers, there is a footnote in which he magnanimously admits my priority.

The centric symbol, to those who understand its use, long remained the one expression of the chemical behaviour of benzene which represented it as symmetrical. Until spatial considerations were introduced, it could not be extended. The small fry buzzed up against it at intervals and scoffed—their narrowness of outlook was only too obvious.

X-rays have altered our outlook. Some day we shall recognise how really great has been the advance under their all-seeing guidance. Moseley's method of arranging elements, combined with Aston's accurate ballistic determinations of atomic weight, have placed the elements once for all upon a firm foundation. X-ray analysis itself has disclosed molecular structure up to its minutest details—rarely finding it to be otherwise than chemists had supposed. From early days, I had thought that the clue to molecular structure would come through crystalline structure—this led me to advocate crystallography and to discover Sir William Pope's geometric genius and skill.

The beginning was made by Sir William Bragg showing that Diamond-carbon was just a collocation of regular tetrahedra—a pavement in which the atomic centres were ranged in zigzags, at a certain distance apart.

The late William Barlow and I improved on the tetrahedral van't Hoff model by making tetrahedra of four separate rhombic tetrahedra, each typifying a unit of valency. These could be packed closely together to any desired extent. The conclusions that may be drawn with this model, inelastic though it be, are highly significant.

Sir William Bragg and his school have shown that the carbon atoms in the normal paraffins are arranged as in diamond. The distance to the confines of the molecule, however, is about twice that between the carbon centres in the chain. *They have not examined paraffins other than those of the normal series.*

Passing to graphite, Sir William Bragg has shown that this consists of sheets of carbon atoms not only closer together at their centres but with their centres all in the same plane, not stepped. Successive sheets are arranged at distances apart similar to those between contiguous molecules of a normal paraffin.

At this time, I contended that this was probably the normal arrangement in all hydrocarbons other than the normal paraffins and the diamond. X-ray determination of benzene derivatives made thus far all show they contain their carbon in this form—which I would term *ethenoid* (or graphitoid) as opposed to the *paraffinoid* in diamond, apparently the rarer form. *The Isoparaffins should be a test of the hypothesis.*

The polymethylenes (including the carotenoids, probably have their contiguous carbon atoms arranged in zigzags, in beltlike form; maybe they are of simple rhombic outline.

To go back to the plagiarists, shortness of memory of previous work is an old sin. My son and I have witnessed the adsorption of our early enzyme work and its silent reappearance *as from Bayliss*—which, of course, we have taken to be a compliment. The receiver of priority claims in hell must do a fair business.

One of the worst of recent offenders is Professor Waldschmidt-Leitz (Blue Bits, August 7), who calmly makes no reference to our enzyme work but dates from Willstätter, 1928. If he will refer to the *Proceedings of the Royal Society of 1913*, he will find that we have given pretty pictures of an enzyme, even including the Northrop protein as a component. Most of the points touched on by Waldschmidt-Leitz in his interesting and valuable summary have been touched upon by us at one time or another. It will be well in future if we all play fair in these matters.

My old friend Duisberg was a past master in arrogantly claiming both here and in America that the German was a superior being as a chemist. The fiction is long since abolished and was never true.

The limit of toleration is reached, in your issue of October 3, in an article headed "Molecular Structure of Water—A New Conception of German Origin," describing the antics of Professor Debye at Pittsburg recently. He calmly claims (with Hückel) to have revolutionised ideas about the molecular structure of water. I hope Wilder D.B. was present and will have let his suspendoids down (see my Messel Lecture) to enjoy the joke. The new doctrine is as old as the hills. These Germans are intolerable in their conceit. Debye and Hückel, having taken themselves seriously and spread a smoke screen of mathematics over their tracks, have entirely obfuscated the chemical problems of solution. It were time that we ceased to throw our arms round the neck of every foreign intruder who brings forward a high-flown physical speculation claiming that it has to do with chemistry when it is merely his complex way of attempting to read facts he does not understand.—Yours faithfully,

HENRY E. ARMSTRONG.

A New Superphosphate Factory at Avonmouth

Equipment for Making 70,000 tons of Superphosphate per Year

SIR ROBERT HORNE, M.P., opened a large new superphosphate factory for National Fertilisers, Ltd., at Avonmouth on November 12.

Fison, Packard and Prentice, Ltd., and Imperial Smelting Corporation, Ltd., have combined their fertiliser interests in the West of England in National Fertilisers, Ltd., who have erected this new superphosphate factory. The acid requirements are drawn from The National Smelting Co., Ltd., a subsidiary of Imperial Smelting Corporation, Ltd., who are producing both zinc and sulphuric acid on adjacent sites. The superphosphate manufacturing process used at the new factory is identical with that used by Fison, Packard and Prentice, Ltd., at their Ipswich works, and is the greatest advance on anything hitherto known.

Aerial Ropeway Transport

At a luncheon which preceded an inspection of the factory, Sir Robert Horne acknowledged the facilities and encouragement which the Bristol Port Authority had given in connection with its construction, and said that great and most beneficial results were expected from that enterprise. It had already given help to the unemployment problem since 110 contractors with their workmen had been engaged in the erection of the factory and its equipment. The plant would compare favourably with anything that existed in any part of the world, and was the most up to date that could be devised.

The new factory is designed for a production of 75,000 tons per annum of superphosphate. The site extending to 12 acres is adjacent to the Avonmouth Docks, the largest and best equipped docks in the West of England. Cargoes of the raw materials can be discharged at the docks and transported to the new factory by means of an aerial ropeway at the rate of 1,500 tons per 8-hour shift. This aerial ropeway has an operating length of over two miles. Similarly, the finished fertilisers can be loaded back to ship in bulk for despatching to all parts of the world.

Superphosphate is made by dissolving finely ground phosphate rock in sulphuric acid. It is by this means that the insoluble phosphates are converted into water soluble phosphates and are so rendered into the form required for agricultural use.

Lead Lined Rotating Autoclaves

A conveyor receives the phosphate rock from the aerial ropeway unloading station and is provided with a mechanical throw-off carriage for discharging the material into any desired part of the store. The conveyor is suspended from the roof of the phosphate store building and forms part of the conveying system between the ropeway unloading station and the store. The total length of this system is 500 feet and it has an operating capacity of 1,600 tons per 8-hour shift.

The phosphate store is 300 feet long by 114 feet span and has a storage capacity of 20,000 tons of rock phosphate. The phosphate is reclaimed from the store by means of an electrically operated scraper shovel at the rate of 45 tons per hour. This shovel discharges into an underground hopper where it is fed to the main conveyor transporting the phosphate rock to the grinding plant.

Three autoclaves or rotary digestors have been installed, each with a capacity of 25,000 tons per annum. They are cylindrical homogeneously lead lined vessels, each weighing, when operating, nearly 60 tons. Each vessel is steam jacketed to enable the correct temperature to be maintained during the process, and they are built to withstand both pressure and vacuum. During the operation they rotate slowly. The charge of finely ground rock phosphate and sulphuric acid required for each charge is automatically weighed and introduced into the autoclaves through special valves.

The superphosphate building has a storage capacity of 29,000 tons of the finished product and is the largest store building for superphosphate in the British fertiliser industry. An overhead electric grab crane is used to distribute materials within the store. The building is 300 feet long by 100 feet wide and is built on 734 reinforced concrete piles driven 70 feet into the ground. Along the east side of the store runs a covered loading platform adjacent to the private railway siding and at the north end is a further covered loading platform for road traffic. Provision is made in the main building for two towers for the installation of the mixing, grinding, screening and bagging plants, each with a capacity of 30 tons per hour.

The sulphuric acid required for the manufacture of superphosphate is supplied by the National Smelting Co., Ltd., from their extensive acid plant which is adjacent to the new factory. The acid is conveyed by means of pipe lines between the two plants and its temperature and strength is controlled by means of a special control plant located on the new factory site.

Imperial Chemical Industries, Ltd.

Deferred Shareholders' Appeal Dismissed

THE House of Lords—Lord Blanesburgh, Lord Russell of Killowen, and Lord Maugham—dismissed without costs on November 13, the appeal by Mr. John Kennedy Carruth, acting on behalf of himself and the other holders of deferred shares in Imperial Chemical Industries, Ltd., against an order of the Court of Appeal dated April 1, 1936, dismissing the appeal of deferred shareholders of the company from an order of Mr. Justice Eve, confirming the reduction of capital from £95,000,000 to £89,565,859 resolved on by the company on May 1, 1935.

One of the contentions of the appellant was that the resolution for the reduction of capital was *ultra vires*, because redundancy had not been alleged, but at the close of the argument for appellant, Lord Blanesburgh intimated that their lordships did not wish to hear counsel for respondents in reply upon this contention. They did, however, hear argument from respondents' counsel upon the other contentions of appellant, namely, that the resolution authorising the scheme of capital reconstruction was a nullity because it was not, as he alleged, passed at a separate meeting of deferred shareholders as required by the company's articles of association; that the ratio of four deferred shares for one ordinary share was not one that was fair to the deferred shareholders, and that there were important omissions of fact from the circular of the board of Imperial Chemical Industries, issued for the guidance of shareholders. Appellant did not impute any want of good faith on the part of the directors of Imperial Chemical Industries, Ltd., in relation to the circular.

Lord Blanesburgh, in announcing the decision of the House to dismiss the appeal without costs, said that, in the reasons which their Lordships would give in writing, they would explain why, in the special circumstances, they thought it right to make that order with reference to costs.

THE Gold-und Silberscheideanstalt A.G., of Frankfort-on-Main, has extended the scope of its chemical interests by its recent purchase of the Dr. L. C. Marquart, A.G., of Beuel, near Bonn, Rhineland, manufacturing a series of metals and metal-salts used largely in the ceramic pigment and other branches of the Scheideanstalt's ramified business. Acquisition of the Marquart concern thus gives the Scheideanstalt direct control over a source of raw materials important for its processing chemical plants.

X-Rays in the Identification of Aliphatic Compounds

A New Application of Crystal Analysis

THE rod-like structure of the aliphatic compounds makes it possible to identify individual members of a homologous series by a single crystal measurement, said Dr. S. H. Pyser, of the University of Bristol, in a paper on "The Use of X-Rays in the Identification and Estimation of Mixtures of Aliphatic Compounds," read at a joint meeting of the Liverpool Sections of the Society of Chemical Industry and the Institute of Chemistry, at Liverpool University, on November 20.

The habit of many aliphatic compounds is to crystallise in flakes formed from parallel sheets one molecule thick, in which the chains are packed closely side by side. The chain axes are either parallel or slightly inclined to the normal to the sheet surfaces. When the flakes are rubbed on a glass mount they set themselves parallel to the glass surface, and can be used to reflect X-rays on to a photographic plate as if they constituted a single crystal surface. Such surfaces have the property of reflecting X-rays, but only at certain specific angles, and the possible reflecting positions are determined by Bragg's Law, which states the relation between the glancing angle of reflection and the thickness of the molecular sheets.

The "Length" of the Molecule

The photographs, continued Dr. Pyser, show a series of parallel lines constituting various "orders of reflection, and the longer the molecular chains the more closely are these lines crowded together on the plate. Measurement of the plate gives the angles at which reflections have occurred, and allows the thickness of the molecular sheets to be calculated. The length so obtained is known as the "*spacing*," and is directly proportional to the length of the molecule. The spacings of an homologous series when plotted against the number of carbon atoms in the chain lie on a straight line, so that measurements on a few members of a given series allow the prediction of the spacing of any other member. Such measurements can be used to identify a pure aliphatic compound.

If a mixture of two or more homologous compounds is crystallised the photograph usually shows *not* two or more sets of lines due to the spacings of the individual substances, but a singe set giving one spacing characteristic of the mixture. Graphs may be constructed showing the relation between the spacings and the composition of synthetic mixtures, and used for comparison purposes. These graphs are *not* linear.

Interpretation of Spacing Composition

The interpretation of spacing composition graphs is complicated by the polymorphism of most aliphatic compounds, because the crystal form adopted by any particular series may vary with the method of crysfallisation and with heat treatment. The polymorphism has been carefully examined, and is on the whole a help in deciding the composition of a mixture. It is known, for instance, that the addition of 5 per cent. of the next higher member to an even paraffin will cause it to crystallise in a modification in which the chain is vertical, whilst if it were pure and crystallised from the same solvent it would come down with a tilted chain. The spacing of the latter modification is much shorter than the former and is easily distinguished, so that there is no difficulty in deciding if an even chain hydrocarbon is 5 per cent. impure. The melting point is no test of this, for the melting point-composition curves are linear, and addition of 2.5 per cent. of each of the next higher and lower homologues to a paraffin would not affect either the melting point or the molecular weight.

The melting point-composition curves for acids and alcohols have a marked depression, and when a family of such curves is constructed for pairs of acids they show considerable overlap. A melting point of 79.5° C., for instance, is characteristic of five binary mixtures of the acids containing 20, 22, 24, and 26 carbon atoms. In identifying mixtures of natural acids or alcohols, the possible synthetic binary mixtures having the same melting point are tabulated, and their spacings are then compared with that of the unknown mixture. If a synthetic mixture is found in which there is correspondence for both these constants, and which has the same molecular weight as the unknown the identification is satisfactory. If data do not correspond for binary mixtures, the effect of adding a third and possibly fourth component is studied.

Investigations of a large number of natural plant and insect waxes have proved that these are rarely esters. All the so-called iso-acids present in such waxes have proved to be mixtures of n-acids. It has also been shown that whilst naturally occurring paraffins all have odd-numbered chains, the compounds with active groups are even-numbered. The actual identification of the compounds constituting the waxes has made it possible to suggest a satisfactory metabolism.

Institution of the Rubber Industry

The Microscope and Rubber Technique

A MEETING of the Manchester and District Section of the Institution of the Rubber Industry was held at the Constitutional Club, Manchester, on November 16, when Dr. D. Parkinson and Mr. J. S. Tidmus, B.Sc., F.I.R.I., read a paper entitled "Some Applications of the Microscope to Rubber Technique."

The authors stated that microscopical methods of examination had not hitherto held the place which they merited in the rubber industry. This was probably due to the high standard of technique required in preparing and mounting specimens, and also to lack of experience in interpreting the results obtained. Microscopical examination of rubber compounds opened up certain possibilities. First of all, it provided information with regard to compounding ingredients, secondly, with regard to the dispersion of such ingredients in rubber, and the knowledge of such dispersion disclosed a good deal of information concerning the quality of the product. In certain cases it might even be possible to indicate the source from which particular ingredients were derived.

The method of examination by means of both reflected and transmitted light was explained, and the problem of "blooming" was dealt with in relation to its investigation by microscopical methods. The preparation of specimen slides was also expained, and a screen illustration was shown of the type of microtome used in conjunction with carbon dioxide freezing.

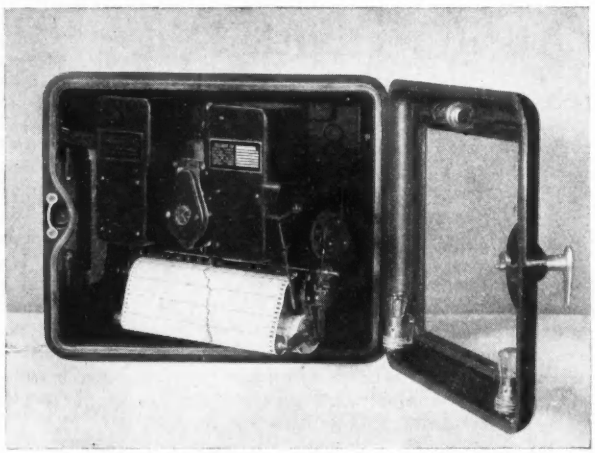
The presence of reclaimed rubber could be detected by means of the microscope. The more common mixtures of "blacks" could also be readily recognised and estimated. The colour appearance of acetylene black was intermediate between that of gas black and lampblack. The paper also dealt with the phenomenon of fluorescence in specimens. The presence of china clay could be detected by reason of porosity and the presence of flakes of mica; magnesium carbonate was somewhat difficult to observe. The presence of stearic acid was recognised, first of all, by blooming.

DURING the fertiliser year, ended July 31, 1936, ammonium sulphate production in Japan totalled 1,179,433 metric tons, greater by 33.2 per cent. than production during the previous fertiliser year.

An Instrument to Measure, Record and Control

A Wide Range of Industrial Uses

IN THE CHEMICAL AGE of September 26 (page 278) preliminary details were given of a new recorder known as the Multelec, which has been added by George Kent., Ltd., of Luton, to their range of industrial instruments. The Multelec opens up a new field for electro chemical measuring instruments; it combines all the advantages of previous types of potentiometric recorders with increased precision and sensitivity of measurement, lightness and simplicity of mechanism, and certain novel features in design.



The Multelec Recorder, showing the chart drive.

Members of the technical Press, including a representative of THE CHEMICAL AGE visited the extensive works of George Kent, Ltd., on November 12, when they were provided with a unique opportunity of witnessing the up-to-date methods employed in the production of this new recorder.

The versatility of this instrument is remarkable, for it is capable of recording and controlling a number of conditions. It is a robust, electrically operated instrument, designed to record or control with a high degree of accuracy any condition such as temperature, *p*H, electrolytic conductivity, etc., which, through the action of a suitable primary element, sets up an electromotive force varying with the condition.

The Multelec is built for industrial use, combining a high degree of accuracy with lasting reliability. It is made in single-point and multi-point form. In the single-point recorder a large capacity pen traces a continuous record. In the multi-point type, as many as six temperature records can be printed concurrently on the same chart, switching from one point to another every minute. Each record is identified by an index number printed on the chart next to every point of the dotted record line. The index number of the point being recorded is shown up boldly on an indicator. The record for two points is also made by pen; an interruptor mechanism is then fitted to the instrument, which causes one record to be made in a dotted line and the other in a series of dashes. Several types of Multelec control are available to meet the requirements of all kinds of processes.

Some outstanding advantages of the Multelec Multi-point Recorder are:—(1) Potentiometric principle ensuring perfect automatic temperature compensation; (2) indifference to high or varying line resistance; (3) frequent automatic current standardising; (4) extra robust galvanometer; (5) high accuracy, independent of galvanometer characteristics; (6) 1/1,000th in. galvanometer deflection instantly detected and recorded; (7) high frequency measuring cycle ensuring immediate recording of any change; (8) ample width of chart *i.e.*, 10 in., and (9) special design permitting control unit to be easily added.

The key point of the instrument is the central mechanism which provides for a rapid and accurate measurement of fluctuating conditions. A sensitive and robust galvanometer of special design detects the slightest change in the condition being measured. The galvanometer needle, when clamped by the scissor mechanism, forms the primary part of a motor-driven relay which deveops so much power that it cannot be restrained by hand. Ordinary mechanical friction is thus defeated and cannot disturb the accuracy of the reading.

Varying line resistance, including even poor contacts at the terminals, will not adversely affect the instrument, since, by virtue of the operating principle employed, the circuit is constantly balanced so that no current can flow through the galvanometer and primary element. The Multelec automatically standardises its own circuit voltage every 54 minutes, thus providing the ideal check on the reliability of the potentiometer. Standardising can also be effected by hand at any time, if required. When the battery is about to need replacing, a white arrow comes into view at the front of the current-adjusting mechanism.

No Lost Motion for Mechanism

No restraint is put upon the galvanometer needle. It is securely clamped together with the whole of the central mechanism at every measuring cycle. This means that the recording mechanism is actuated without a trace of lost motion or "spring"; 1/1,000th in. deflection of the galvanometer needle is reproduced with certainty on the chart. Every Multelec instrument is tested over a period of 36 hours to ensure that these conditions are fulfilled at all points of the scale. The effect of any change in conditions is seen on the recorder within two seconds of its occurrence. This pen can travel completely across the chart in 22 seconds.

The effective width of chart or pen travel is 10 in., giving an open record which can be read with a high degree of accuracy even by unskilled operators. The standard speed is 1 in. per hour. Each chart roll is 120 ft. long, and therefore

General view of the recorder calibrating shop at the works of George Kent, Ltd.

lasts 60 days. Change wheels can be supplied if it is desired to alter the speed to 2 in. or 3 in. per hour. The chart drive is clearly visible in the accompanying illustration.

To facilitate inspection, the whole recording mechanism is mounted on a hinged frame, which can be swung out entirely free from the casing and without interrupting its normal operation. This feature also makes chart roll changin easier.

If the Multelec is perfectly balanced, electrically and mechanically, it will always maintain its accuracy. Provision is made for easy checking of both these conditions. To check mechanical balance, all electrical influences can be isolated by changing one connection at the front of the mechanism. The turning of one setscrew will then effect any adjustment

that may be necessary to restore perfect balance. For electrical balance, the method is that of standardising by hand. By pressing a knob the circuit is changed over from the measuring unit to the standard cell, and the instrument automatically corrects its electrical balance. Its own movement brings the rheostat into the position required for a correct steady voltage to be delivered into the circuit from the dry batteries.

The cost of maintenance is negligible. Spares are supplied with each recorder to cover a period of approximately two years of normal operation. Attention is limited to oiling the mechanism about once a month. The dry batteries, which are of standard bell pattern, will last three months.

The number of employees at the Luton works, which cover about 7½ acres, is nearly 1,600, a large proportion of whom are engaged on work connected with the design and manufacture of meters for the accurate measurement of the flow of water, steam, gas, air, oil, and other fluids under all conditions, also equipment for controlling flow, temperature, pressure and level, and for the automatic control of boilers. In the Multelec instrument the firm has added a most serviceable instrument for industrial use, the versatility of which, when fully appreciated and recognised, will result in its ready adoption for general industrial use and by the chemical industry in particular.

Domestic Coke by Alkali Activities

Results of Research at Winnington

THE North-Western Section of the Institute of Fuel, in conjunction with the Manchester Association of Gas Engineers, held a symposium on the production and utilisation of domestic coke at the Midland Hotel, Manchester, on Wednesday, at which Mr. P. J. Askey, of the research department of Imperial Chemical Industries, Ltd., at Winnington, contributed a paper on "Domestic Coke by Alkali Activation."

Work done several years ago at Leeds by Mr. M. F. Bligh and Mr. H. J. Hodsman, said Mr. Askey, showed that the addition of sodium carbonate to a high temperature coke increased the rate of combustion in an open grate and enabled a more pleasing and a more flexible fire to be produced. This was only one example of the activating effect of alkalies on fuels investigated by Professor Cobb and his collaborators. Since the publication of this work nearly ten years ago the alkali process for the activation of fuels has received little attention from the carbonising industries, in spite of the urge that has existed for the production of reactive solid smokeless fuels. The important reasons for this are, firstly, the fear of alkali attack on the refractories of retorts and coke ovens, and, secondly, the cost of the large quantity of sodium carbonate found necessary to give the activating effect. About 5 per cent. of sodium carbonate seems to have been the minimum quantity required with normal coal or coke, and this would cost at least 5s. to 7s. per ton of fuel.

The Chemistry of Activation

Some work has recently been done at Winnington to see if this quantity of sodium carbonate is really necessary for activation, and the first part of this work was published in July, 1935, in "Fuel." It is only necessary briefly to summarise the results given then and those obtained more recently. It was found that in ordinary coke—containing from 5 per cent. to 10 per cent. ash—the acidic constituents of the ash combined with the sodium carbonate added. Consequently a considerable portion of the sodium carbonate was put out of action so far as any activating effect was concerned. It was then shown that if a mixture of lime and sodium carbonate was added before carbonisation the lime combined preferentially with these acidic constituents, leaving the sodium carbonate free to activate the coke. In this way it was possible to obtain the maximum activity by using lime plus 0.5 per cent. or 1 per cent. sodium carbonate.

There are three advantages arising from this: Less lime than sodium carbonate is required to neutralise the acidic constituents of the ash (owing to the divalency of calcium); consequently the total addition of lime and sodium carbonate is less than sodium carbonate alone; lime is cheaper than sodium carbonate, so that the cost of activation is considerably reduced, and the possibility of alkali attack on the refractories of carbonising plant is reduced because of the smaller amount of sodium carbonate added.

It is advantageous to add the lime and sodium carbonate before carbonising. The addition of the materials after coking presents difficulties which at the moment seem impossible to overcome. Lime could only be added as a slurry or a solid, and it would not be easy to obtain a uniform and controlled distribution. Sodium carbonate could, of course, be added as a solution, for example, during quenching, but the control of the amount added would be difficult. Addition of lime before carbonising and sodium carbonate on quenching would mean two operations, which would increase the cost of the process. Apart from the practical difficulties, any advantage due to increased gas production would be lost. The addition of alkali before carbonising seems, therefore, to be the most suitable method of activation.

One thing which will materially assist the application of alkali activation is the production of cleaner coals. It must be admitted that alkali activation inevitably increases the ash content of a coke. In order to produce a coke of not more than 6 per cent. ash it is necessary, where alkali activation is used, to start with a coal of not more than 3 per cent. ash. With modern improvements in coal washing this can be done at a relatively low cost. Although the phenomenon of alkali activation has been known for a long time, the attempt to apply it in the carbonising industries is very recent. Inevitably there are points which require further investigation before they can be regarded as satisfactory, such as the best method of feeding alkali and securing adequate mixing with the coal. There is also the vexed question of the effect of alkali on the life of refractories. This is not likely to be as serious as some people suggest, but the only satisfactory test is a prolonged trial in a retort or coke oven. Since the introduction of high silica refractories the danger due to salt in coals has become negligible, and there does not seem to be any evidence that alkali should be more dangerous than salt, and there is reason to believe that it should be less dangerous.

Free-burning, Open Grate Coke

When these difficulties are overcome, and there seems no reason why they should not be overcome, alkali activation in some cases alone, in others in conjunction with other methods of increasing the reactivity of coke, should provide a real solution of the problem of preparing a satisfactory free-burning coke by carbonisation in gas retorts or coke ovens.

Assuming 0.5 per cent. sodium carbonate and 1 per cent. lime on the coal are necessary, the cost, including mixing, should be about 1.3s. per ton of coal or about 1.8s. per ton of coke. If 1 per cent. of sodium carbonate is necessary, as it may be in the case of coke ovens, the cost will be about 2s. to 2.5s. per ton of coke. If clean coal is used the cost of cleaning will to some extent be offset by the decrease in the lime required. When the advantages of a reactive coke are considered this does not seem a high price to pay. There is little doubt in the minds of most people that there is a big market for a cheap, free burning, open grate coke.

Personal Notes

MR. J. E. STANWORTH, of Sheffield, and MR. F. R. HARRIS, of London, have been appointed Research Fellows in the Department of Glass Technology at Sheffield University.

MR. ALEXANDER MACKAY, of Mackay, Irons and Co., chartered accountants, Dundee, a director of the Shell Union Oil Corporation, left personal estate in Great Britain of £173,239.

COLONEL WILLIAM T. LOVERING, china clay merchant, who died at Hove, Sussex, on August 21, at the age of 85 years, has left estate of the gross value of £256,167, with net personalty £249,401.

PROFESSOR A. BUTENANDT, the director of the Institute of Organic Chemistry of the Technical University at Leipzig, has been appointed director of the Kaiser Wilhelm Institute of Biochemistry at Berlin-Dahlem. He has also been awarded the Rinecker Gold Medal by the University of Warzburg.

MR. CHARLES F. POOLE, aged 70, of Westfields, Sandbach, Cheshire, formerly a director of Brunner, Mond and Co., Ltd., died on November 11, just before the two minutes' silence. He had been ill for the past few weeks. Mr. Poole began as office boy and rose to be a director of the firm, from which he retired some years ago.

PROFESSOR N. V. SIDGWICK, president of the Chemical Society, lectured on the "Resonance of Organic Chemistry" at the University College, Nottingham, on November 13. The lecture, which was illustrated, dealt with the electronal treatment of organic chemistry and demonstrated the importance of the developments which have taken place during the last few years in structural chemistry.

MR. T. L. JACKS, former resident director of the Anglo-Iranian Oil Co., Ltd., in Tehran, who retired last year after a period of service that extended back to the early days of the company, was the recipient of a gift from his friends and former colleagues presented to him by Sir John Cadman at a gathering at Britannic House last month. The gift took the form of a set of table plate in chiselled silver, specially designed by Mr. Omar Ramsden, and enclosed in a cabinet of limed oak.

MR. JOHN MCBRYDE, who has retired from the post of manager of Bathgate Chemical Works, which he has occupied for the last twenty-four years, has set up a remarkable record of service in the Scottish mineral oil industry. He began work at an early age in the laboratory at Addiewell as long ago as 1872, and thirteen years later was appointed assistant chemist. Having there acquired considerable experience in the processes of sulphuric acid manufacture he was appointed manager of Bathgate Acid Works in 1912. He has thus completed sixty-four years of active service.

MR. EDWARD ROBERTS has retired from the managership of Deans Oil Works after fifty years' service with the Pumpherston Oil Co. His connection with the oil industry began in 1876 and about ten years later he was engaged in the retorting department at Pumpherston Works, which had then been in operation for about a year. After promotion at Pumpherston he was appointed to the management of Deans Crude Oil Works in 1897 and had charge of that unit during the two periods of extension and reconstruction which brought the capacity of the plant up to 1,000 tons of shale per day, making it one of the largest units in the industry.

MR. E. M. BAILEY, who has retired from the position of chief chemist of Scottish Oils, Ltd., is one of the few remaining members of the team which, under the leadership of the late Mr. W. Fraser, built up the prosperity of the Pumpherston Oil Co., subsequently playing an important part in the affairs of Scottish Oils. With the formation of Scottish Oils, combining the interests of all the shale companies, Mr. Bailey's sphere was greatly enlarged, and soon was added the refining of crude petroleum, first explored at Uphall, then at Broxburn and later at Grangemouth.

DR. EDGAR R. DEACON, of Eltham, research chemist at Woolwich Arsenal, left estate of the value of £11,038.

MR. DANIEL D. MOIR has been appointed a public analyst for the County Borough of Croydon in addition to the present public analyst, Mr. Edward Hinks.

MR. WILLIAM TAYLOR, aged 50, of Lower Bobington, Cheshire, manager in the cattle foods department at Lever Brothers, Ltd., Port Sunlight, collapsed and died at the office on November 13.

PROFESSOR F. PANETH will deliver the Sixth Liversedge Lecture on "Study of Transmutation in the Chemical Laboratory" at a meeting of the Chemical Society, at the Institution of Mechanical Engineers, on December 10 at 5.30 p.m.

DR. JOHN D. POLLOCK, chairman of the British Oxygen Co., and of the Metal Industries Co., is to have the honorary degree of Doctor of Science conferred upon him by Oxford University in January. Dr. Pollock is a member of the court of the University of Edinburgh, and is also a Carnegie Trustee.

MADAME JOLIOT-CURIE, who is well known for her researches on radium, has resigned her appointment of Under-Secretary for Scientific Investigation in the French Cabinet, in order to occupy a Chair in the Faculty of Natural Science at the Sorbonne. She has been succeeded by Professor M. Jean Perrin, a foreign member of the Royal Society, who has done some outstanding work on atomic chemistry and was the recipient of the Nobel Medal for physics in 1926.

PROFESSOR PETER DEBYE, of Berlin, has been awarded the Nobel Prize for Chemistry for 1936 for his contribution to the knowledge of the structure of the molecule. Professor Debye, who is 52, was born at Maastricht, Holland. He became professor at the High School of Technology at Zurich in 1920 and since 1935 has been at the Kaiser Wilhelm Institute for Physics in Berlin. The Academy of Science has divided the Nobel Prize for Physics between PROFESSOR V. F. HESS, of Innsbruck University, and PROFESSOR CARL DAVID ANDERSON, of the Californian Institute of Technology. Professor Hess is rewarded for his discoveries in connection with cosmic radiation, and Professor Anderson for his discovery of the positron. The prizes are worth about £8,000.

Arsenic Utilisation in Sweden

New Outlets Sought

THE Boliden Mining Co. is actively searching for commercial outlets for the by-product arsenic which it has accumulated at Ronnskar. The company operates two wood preservation plants, one for impregnating poles and the other for lumber. It is reported that two Swedish railways have tested railway ties impregnated with an arsenical compound. Experiments have been made in Goteborg Harbour and at the Zoological Marine Laboratory of the Royal Academy of Science, Kristineberg, which have given evidence to the value of arsenic in preventing lumber damage caused by ship worms. The possibility of employing arsenic impregnated lumber for home construction is being investigated. Spraying with an arsenic compound concrete on wooden marine piling has been tried by the Royal Board of Roads and Water Constructions, which method is said to be more expensive than impregnation.

THE Argentine Sanitary Works Department has purchased 4,000 metric tons of bauxite from Brazil in order to experiment with the local manufacture of aluminium sulphate. For some time the Department has been making a solution of aluminoferric sulphate from local earth and sulphuric acid, which has been used in water purification for Buenos Aires.

British Overseas Chemical Trade in October

According to the Board of Trade returns for the month ended October 31, 1936, exports of chemicals, drugs, dyes and colours were valued at £1,910,341, as compared with £2,070,328 for the corresponding month of 1935, showing a decrease of £159,987. Imports were valued at £1,216,456, as compared with £1,342,026, a decrease of £125,570. Re-exports amounted to £34,994, against £32,204, an increase of £2,790.

Imports

	Quantities October 31		Value. October 31	
	1935.	1936.	1935.	1936.
Acids—				
Acetic .. .. cwt.	20,272	20,005	29,110	23,224
Boric (boracic) .. ,,	3,900	3,540	3,669	3,553
Citric .. .. ,,	1,059	1,260	4,091	4,938
Tartaric .. .. ,,	1,990	975	8,378	4,013
All other sorts .. value	—	—	12,081	5,410
Borax .. .. cwt.	9,000	19,307	5,045	9,688
Calcium carbide .. ,,	97,304	114,109	54,735	61,836
Fertilisers, manufactured				
Superphosphate of lime ton	205	1,752	391	3,160
All other descriptions ton	7,210	3,639	26,966	18,042
Phosphorus .. cwt.	2,361	—	7,770	—
Potassium compounds				
Caustic and lyes ,,	12,888	13,112	13,700	13,710
Chloride (muriate) ,,	298,770	266,499	89,417	85,271
Kainite and other mineral fertiliser salts ,,	459,893	391,598	80,544	69,817
Nitrate (saltpetre) ,,	9,653	38,413	7,951	14,447
Sulphate .. ,,	228,114	200,766	94,194	87,903
All other compounds ,,	14,125	9,988	22,753	14,612
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	182	205	145	157
Chromate and bichromate .. .. cwt.	6,198	4,222	7,816	4,958
Cyanide .. .. ,,	7,340	6,922	17,434	14,256
Nitrate .. .. ,,	30,910	50,046	6,114	10,642
All other compounds ,,	22,431	24,364	14,554	17,731
Other chemical manufactures .. .. value	—	—	326,786	261,623
Drugs, medicines and medicinal preparations—				
Quinine and quinine salts .. .. oz.	105,963	73,625	8,909	6,247
Medicinal oils .. cwt.	2,788	3,559	14,483	8,623
Proprietary medicines, value	—	—	42,540	43,744
All other sorts .. ,,	—	—	40,415	50,241
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs from coal tar .. cwt.	4,638	4,149	131,568	114,075
Extracts for dyeing ,,	3,946	5,032	10,345	10,252
Extracts for tanning (solid or liquid)—				
Chestnut .. ,,	25,518	22,505	17,030	16,813
Quebracho .. ,,	13,131	14,563	10,711	12,512
All other sorts ,,	99,744	68,518	68,831	50,786
All other dyes and dyestuffs .. .. ,,	863	872	14,344	17,687
Painters' colours and materials—				
White lead (basic carbonate) .. cwt.	8,908	6,179	11,305	8,253
Lithopone .. ,,	21,258	25,265	13,175	15,737
Ochres and earth colours cwt.	35,193	59,111	11,572	18,900
Bronze powders ,,	2,301	2,158	15,116	14,342
Carbon blacks .. ,,	36,193	37,228	55,440	54,324
Other pigments and extenders, dry .. cwt.	31,491	41,110	8,805	9,268
All other descriptions ,,	14,107	16,140	33,898	29,661
Total .. .. value	—	—	1,342,026	1,216,456

Exports

	Quantities October 31		Value. October 31	
	1935.	1936.	1935.	1936.
Acids—				
Citric .. .. cwt.	3,287	2,313	14,746	10,065
All other sorts .. value	—	—	22,932	19,537
Aluminium compounds ton	7,896	4,413	73,701	42,825
Ammonium compounds—				
Sulphate .. ton	19,519	20,353	117,256	124,504
All other sorts .. ,,	4,159	1,248	44,398	16,575
Bleaching powder (chloride of lime) .. ,,	79,402	47,287	19,813	11,882
Coal tar products—				
Cresylic acid .. gal.	152,280	193,935	15,371	25,093
Tar oil, creosote oil, anthracene oil etc. gal.	1,093,617	2,097,152	33,529	51,798
All other sorts .. value	—	—	17,874	22,145
Copper, sulphate of ton	1,532	488	21,409	7,164
Disinfectants, insecticides, weed killers .. cwt.	37,104	33,893	80,442	70,179
Fertilisers, manufactured ton	10,672	22,909	46,338	54,197
Glycerine .. .. cwt.	11,320	19,059	27,018	52,800
Lead compounds .. ,,	17,882	18,636	21,149	25,324
Magnesium compounds ton	492	496	11,757	11,744
Potassium compounds cwt.	10,716	8,525	17,587	15,324
Salt (sodium chloride) ton	28,175	30,289	70,238	81,159
Sodium compounds—				
Carbonate including crystals, ash and bicarbonate .. cwt.	312,752	343,929	78,432	69,533
Caustic .. .. ,,	217,510	164,198	109,590	76,321
Nitrate .. .. ,,	33,073	21,532	11,296	7,300
Sulphate, including salt-cake .. .. ,,	120,939	81,014	9,792	7,777
All other sorts .. ,,	82,712	74,455	88,961	87,973
Zinc oxide .. .. ton	1,191	1,276	22,597	22,597
All other descriptions value	—	—	2261,343	236,056
Drugs, medicines, etc.—				
Quinine and quinine salts .. .. oz.	161,163	111,364	16,901	12,130
Proprietary medicines value	—	—	127,759	131,583
All other descriptions ,,	—	—	168,705	154,570
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs from coal tar—				
Alizarine, alizarine red and indigo (synthetic) .. cwt.	2,544	1,861	17,371	11,112
Other sorts .. ,,	7,955	6,858	115,835	100,058
All other descriptions ,,	29,124	24,705	36,563	28,207
Painters' colours and materials—				
Pigments and extenders, dry—				
Ochres and earth colours .. cwt.	17,824	17,128	18,137	15,975
Other descriptions ,,	29,465	28,583	42,169	35,499
White lead .. ,,	7,281	9,180	14,262	18,683
Paints and painters' enamels, prepared cwt.	44,906	46,158	121,212	120,151
Varnish and lacquer (clear) .. .. gal.	103,027	77,779	40,024	30,832
Printers' ink .. cwt.	5,108	4,365	30,760	26,417
All other descriptions ,,	43,524	39,232	83,061	75,252
Total .. .. value	—	—	2,070,328	1,910,341

Re-Exports

	Quantities October 31		Value. October 31	
	1935.	1936.	1935.	1936.
Chemical manufactures and products .. value	—	—	17,578	15,642
Drugs, medicines and medicinal preparations value	—	—	12,471	14,080
Dyes, dyestuffs and extracts for tanning cwt.	526	1,877	1,403	2,392
Painters' colours and materials .. .. cwt.	291	4,019	692	2,880
Total .. .. value	—	—	32,204	34,994

From Week to Week

THE STAFF DINNER DANCE of the British Oxygen Co. will be held at Grosvenor House, on December 11.

JAMES AND JOHN WHITE, LTD., chemical manufacturers, Glasgow, have given £1,000 to the Guarantee Fund of the Scottish Empire Exhibition.

AN EXHIBITION OF DYESTUFFS was staged by Imperial Chemical Industries, Ltd., at the Recreation Hall of Scottish Dyes, Grangemouth, on November 14.

THE ADDRESS OF THE Wholesale Drug Trade Association has been changed from 45 Gordon Square to 16 Gordon Square, London, W.C.1, and the telephone number from Museum 0686, to Euston 4581.

AN INVENTION TO REDUCE THE COST OF RUBBER PRODUCTION is now being tested in this country. The invention is a machine which in one process converts the latex into rubber powder as distinct from sheet or crepe rubber.

THE PAISLEY WORKS OF DOULTON AND CO., LTD., who are well known as makers of acid-proof stoneware plant for the chemical industry, are to be closed down as soon as the work at present on hand has been completed. Future orders will then be executed at one of the company's works in England.

A LECTURE ON "COAL ANALYSIS," was recently delivered to the Leeds Smoke Abatement Association by Mr. A. M. Williams, who described the methods of sampling and analysis used in the Government's physical and chemical survey of the national coal deposits.

THE NEW CHLORINE FACTORY which is being erected in Finland for Imperial Chemical Industries, Ltd., will cost 40 million Finnish marks. It will have an annual capacity of 3,000 tons of liquid chlorine at the commencement of operations, but the output will be subsequently increased to 5,000 tons.

AT LEAST 34 PEOPLE WERE KILLED and about 200 injured in an explosion at the powder works at St. Chamas, 25 miles northwest of Marseilles, on November 16. A whole block containing stores of gunpowder and tonite (guncotton) blew up, while workers were fighting a fire in another part of the works.

THE BRITISH SCIENCE GUILD has now been incorporated with the British Association for the Advancement of Science. It is a condition of the amalgamation that the council of the Association shall appoint a committee which shall preserve the name of the Guild and be entrusted with arrangements for lectures already initiated by it.

THE NINETEENTH ANNUAL DINNER of the British Association of Chemists will be held at the Waldorf Hotel, London, on November 27. Tickets 12s. 6d. (exclusive of wine), may be obtained from the general secretary, 175 Piccadilly, London, W.1. The annual meeting will be held at the Waldorf Hotel, on November 28, at 3 p.m.

THE HIGHEST MONTHLY STEEL OUTPUT ever recordued in this country was achieved during October. The month's output of steel at 1,060,500 tons exceeded the September figures by 33,500 tons, and the average for 1935 by 240,300 tons. The daily average production was 39,278 tons, compared with 39,500 tons in the previous month and 34,908 tons in August. Pig-iron production reached the highest level since 1929.

THE RAMSAY CHEMICAL DINNER held annually as Glasgow under the joint auspices of nine chemical societies, will be held at the Central Hotel, Glasgow, on December 4, with Professor G. G. Henderson presiding. Lord Leverhulme, president of the Society of Chemical Industry, will propose "The Profession of Chemistry," and Dr. Robert H. Pickard, president of the Institute of Chemistry, will reply.

ABOUT ONE HUNDRED EMPLOYEES at the works of the British Tar Products, Ltd., Cadishead, have through the Chemical Trades Union tendered notices to cease work this week-end unless their demands for improved conditions of labour and increased pay were conceded. The dispute is in the hands of the Chemical Trades Employers' Association. The union has put in a demand for an increase of 3d. and 4d. per hour in excess of the standard recognised by the Joint Industrial Council.

PLANS FOR THIRTEEN MAJOR ADDITIONS to existing factories have been submitted to the Hull Corporation, making a total of 73 additions to industrial establishments for which plans have been passed during the year. Industries for which extensions or new factories have been built include: fish glue, tin box making, household chemicals, iron foundry, polishes, vegetable oil extraction, paint, oil refinery, plaster-board works (new industry), surgical dressings, metal drums, welding, cattle cake, cod liver oil refining (additions to new works) timber drying kilns, metal plating, and vitreous enamel. The Hull fishing industry, which has recently established the world's largest cod liver oil refinery, has completed a further addition to its industrial enterprise by the installation of a factory for the production of varying grades of fish glues.

A STATE PETROL MONOPOLY is to be established in Chile, and will come into operation on January 1 next.

THE IRON AND STEEL INSTITUTE has made a grant of £250 for research in the Metallurgical Department, University of Manchester, on behalf of the Alloy Steels Research Committee.

THE 96TH ANNUAL MEETING of the Chemical Society will be held at Burlington House, on March 18. The anniversary dinner will be held in the evening of the same day at Grosvenor House, Park Lane, London.

THE PAY RATES OF ALL WORKERS of the Viscose Co., New York, will be raised by 5 per cent., with effect from November 30. About 15,000 operatives are affected. The Viscose Co. is owned by Courtaulds.

THE PAPER ON "Fluorescence Analysis as an Aid to the Chemist," which Dr. Julius Grant was to have given on Thursday to the Bristol section of the Society of Chemical Industry has been postponed until February.

QUESTIONED IN THE HOUSE OF COMMONS on November 16, by Mr. David Adams, (Consett) about oil from coal operations, Captain Crookshank stated he was not yet in a position to make a statement on the results of the commercial scale experiment in hydrogenation being carried out at Billingham.

A NEW COPPER SMELTING WORKS at Melton, East Yorkshire, will be put into production by Capper, Pass and Sons, of Bristol, in June next. The site occupies an area of 30 acres. The steel buildings which are to house the smelting and refinery plant are already completed and a jetty has been built to project into the river Humber.

APPLICATION FORMS AND PARTICULARS of the associate-membership examination of the Institution of Chemical Engineers for 1937 are now obtainable from the Hon. Registrar of the Institution, 56 Victoria Street, Westminster, S.W.1, together with the Institution memorandum on the training of a chemical engineer. The application forms are returnable not later than December 21.

THE IMPORT DUTIES ADVISORY COMMITTEE has under consideration the question of removing pyrethrum flowers from the free list. Any representations which interested parties may desire to make in regard to this matter should be addressed to the Secretary, Import Duties Advisory Committee, Shell-Mex House, Strand, London, W.C.2, not later than December 10.

THE NEW EXHIBITION BUILDINGS in course of construction at Earls Court will not be completed in time to permit of them being utilised for certain sections of the British Industries Fair of 1937 to be held from February 15 to 26. The Department of Overseas Trade announces, therefore, that the London sections of the Fair will be held at Olympia and the White City as in 1936.

SHIPMENTS OF CHINA CLAY during October were as follows: Fowsy, 50,093 tons china clay; 4,094 tons china stone; 3,214 tons ball clay. Par, 6,828 tons china clay; 668 tons china stone. Charlestown, 6,676 tons china clay; 593 tons china stone. Padstow, 1,782 tons china clay. Looe, 240 tons china clay. Newham, 163 tons china clay. Plymouth, 89 tons china clay. By rail, 5,794 tons china clay, making a total of 80,234 tons, compared with 77,384 tons in October, 1935, and 73,617 in October, 1934.

IN VIEW OF SERIOUS COMPETITION which the Indian lac industry has to meet from synthetic resins with their uniform and standard compositions, the vice-chairman of the Imperial Council of Agricultural Research, India, has recently stressed the need of more intensive research and of also devising some workable system of standardisation in respect of the export market. The total internal consumption of lac in India amounted to only one per cent. of the total output, though there is a potential market in the country itself. Indian shellac has at present certain advantages by virtue of its relative cheapness and durability, but the demand from overseas shows decline.

AT A MEETING of the newly-founded Public Schools Business Society, 83 Pall Mall on Wednesday, Sir Ernest Benn spoke on "The Effect of Modern Politics on Industry." Referring to Herbert Spencer's prophetic essay, "Man versus the State," he said that the last thirty years had been characterised by the rapid development of the regulating part of society, to an extent that was a threat not merely to our business and economic life, but, even more dangerous, to individual personality and character. The explanation was, of course, that universal suffrage was still in its infancy and the 30,000,000 voters who now had power over business and everything else could only learn wisdom by experience and education. The menace of the mass idea, fostered by the radio, the million circulation Press and the films, would eventually be realised in this country. The lesson of the Totalitarian States, where millions were dragooned into thinking and acting exactly as they were told, would not be lost on Englishmen, and he looked forward to the day when the popularly-discredited Victorian ideas would be accepted again.

Chemical Notes from Foreign Sources

Greece

A CITRIC ACID FACTORY operating an American process is being built in Athens.

Czechoslovakia

STOCKS OF RADIUM PREPARATIONS and uranium pigments at the Joachimstal radium mines have increased considerably in the past year, while keen competition from abroad has weakened the price of radium. The existing system of short-time working (4 days per week) is therefore to be continued in 1937.

Japan

OWING TO AN INCREASED DEMAND FOR CARBON TETRACHLORIDE the Narkai Sarashiko K.K. is increasing the monthly capacity of its Tosa plant from 30 to 60 tons.

SODIUM PERBORATE MANUFACTURE has now been commenced by the Yedogawa Kogyosho, who are marketing this article under the name of "Perbon."

Denmark

PRODUCTION OF CRUDE CRYOLITE by the Oresunds Chemiske Fabriker increased from 12,000 tons in 1934 to 18,500 tons in 1935, although sales of refined cryolite only rose from 11,600 to 11,800. Cryolite powder is now sold on a large scale under the brand name of Cryosid as an insecticide, with South Africa as one of the chief markets. Further trials on its use in this connection are proceeding at the State Experimental Institute for Plant Pathology at Lyngby, and at a number of foreign government laboratories.

Germany

A NEW CALCIUM CHLORIDE FACTORY with a monthly production capacity of 6,000 tons, utilising effluents run in the past into the River Saale, is to be constructed by the Deutsche Solvay-Werke, of Bernburg.

France

PLANS TO ESTABLISH A SHALE OIL INDUSTRY on an extensive scale are being sponsored by the Government, a representative of the Mines Department of the French Ministry of Industry having been sent to Esthonia to make a study of the technical aspect of the shale oil industry in that country.

Latvia

ESTABLISHMENT OF A CELLULOSE FACTORY at Windau is under consideration by a Government commission. An old granary near the harbour is regarded as exceptionally suitable for this purpose, but the Government has not yet come to a final decision.

Finland

IMPREGNATION OF WOOD CAN BE SATISFACTORILY EFFECTED by means of a mixture of calcium sulphocyanide and mercuric chloride which is absorbed more rapidly than sublimate alone. Pine wood with a density of 0.55 is more readily impregnated than dry wood. The recommended operating conditions are a temperature of 50-60° C., a vacuum in the wood of 500 mm. and a pressure of 8 to 10 atmospheres on the solution to be injected into the wood ("Pappers-o Trävaru-Tidsker," Finland, 1936, No. 2 and 3).

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

STABLE BLENDED OILS.—Standard Oil Development Co. April 27, 1935. 28167/35.

PROCESS FOR MANUFACTURING LUBRICANTS.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 27, 1935. 4974/36.

REFORMING OF NAPHTHA.—Houdry Process Corporation. April 27, 1935. 10524/36.

MANUFACTURE OF AROMATIC SULPHOCARBOXYLIC ACID-AMIDES.—Soc. of Chemical Industry in Basle. April 27, 1935. 10840/36.

PROCESS FOR EFFECTING HYDROGENATION and dehydrogenation of organic compounds.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 29, 1935. 11316/36.

PURIFICATION OF CAUSTIC SODA SOLUTIONS.—Pennsylvania Salt Manufacturing Co. April 27, 1935. 11648/36.

PROCESSES FOR THE PURIFICATION OF CRUDE PHOSPHORIC ACID.—Pulverfabrik Skodawerke-Wetzler, A.-G. April 30, 1935. 11697/36.

ADHESIVE BACKING.—E. I. du Pont de Nemours and Co. April 27, 1935. 11897/36.

METHOD FOR TREATING COMBUSTIBLE SUBSTANCES.—Bayerische Stickstoffwerke, A.-G. April 30, 1935. 11898/36.

MANUFACTURE OF CARBONATES and hydroxides of the alkali metals and of fluorides and other salts.—Consolidirte Alkaliwerke. April 27, 1935. 11979/36.

MANUFACTURE OF ALYALI-METAL SALTS.—A. E. A. S. Cornelius. May 1, 1935. 12039/36.

MANUFACTURE AND PRODUCTION OF COATING-COMPOSITIONS.—I. G. Farbenindustrie. April 29, 1935. 12068/36.

PREPARATION OF GASES FOR POLYMERISATION.—Houdry Process Corporation. May 1, 1935. 12181/36.

PHENOL ALDEHYDE CONDENSATION PRODUCTS.—E. I. du Pont de Nemours and Co. May 1, 1935. 12444/36.

HYDROGENATION PROCESS.—Rohm and Haas Co. May 9, 1935. 5157/36.

LUBRICATING OILS.—Armour and Co. May 4, 1935. 11308/36.

ASPHALTIC PRODUCTS and method of producing same.—Socony-Vacuum Oil Co., Inc. May 7, 1935. 6044/36.

EXTIRPATION OF RODENTS.—I. G. Farbenindustrie. May 8, 1935. 12570/36.

RUBBER-LIKE CHLORO-2-BUTADIENE-1, 3 POLYMERS.—United States Rubber Products, Inc. May 4, 1935. 12575-6/36.

PROCESS FOR THE PRODUCTION OF SUBSTITUTED PHENOLS AND FUELS.—Beck, Koller, and Co. (England), Ltd. May 7, 1935. 12628/36.

SOFTENING OF NITROCELLULOSE PLASTICS and compositions therefor.—E. I. du Pont de Nemours and Co. May 9, 1935. 12739/36.

MANUFACTURE OF MONOAZO DYESTUFFS.—I. G. Farbenindustrie. May 9, 1935. 12826/36.

Specifications Accepted with Date of Application

MANUFACTURE OF CYANINE and related dyes.—Kodak, Ltd., N. I. Fischer and Dr. F. M. Hamer. March 21, 1935. 455,710.

MANUFACTURE OF DYESTUFFS of the anthraquinone series.—W. W. Groves (I. G. Farbenindustrie). March 22, 1935. 455,711.

MIXED ESTER DERIVATIVES OF GLYCOL and compositions containing the same.—Carbide and Carbon Chemicals Corporation. May 8, 1934. 455,922.

MANUFACTURE OF SOLUTIONS of bismuth salts.—I. G. Farbenindustrie. April 27, 1934. 455,784.

SAPONIFICATION OF CELLULOSE ESTER FILAMENTS, threads, ribbons, and like materials.—British Celanese, Ltd., H. Dreyfus, and R. W. Moncrieff. April 29, 1935. 455,925.

PIGMENTS AND FILM-FORMING COMPOSITIONS containing the same.—H. A. Gardner. May 23, 1934. 455,717.

VARNISH COMPOSITIONS.—Bakelite, Ltd. June 22, 1934. 455,974.

COMPOSITIONS CONTAINING SYNTHETIC RESINS.—Bakelite, Ltd. June 22, 1934. 455,975.

SYNTHETIC RESINS and their production.—Bakelite, Ltd. June 22, 1934. 455,976.

USE OF ZINC SULPHIDE as an opacifier for enamels, glasses, and the like.—R. W. Hannagen. May 1, 1935. 455,980.

APPARATUS FOR THE REMOVAL OF CARBON DIOXIDE and/or hydrogen sulphide from ammonia.—Coutts and Co., and F. Johnson, (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). May 1, 1935. 455,865.

MANUFACTURE OF UNSATURATED ORGANIC COMPOUNDS.—J. W. C. Crawford, and Imperial Chemical Industries, Ltd. May 3, 1935. 456,147.

MANUFACTURE OF HALOGEN DERIVATIVES OF RUBBER.—J. G. Moore, and Imperial Chemical Industries, Ltd. May 3, 1935. 456,148.

RUBBER DERIVATIVES.—J. P. Baxter, and Imperial Chemical Industries, Ltd. May 3, 1935. 456,149.

MANUFACTURE OF HALOGEN-CONTAINING RUBBER DERIVATIVES.—R. C. Cooper, and Imperial Chemical Industries, Ltd. May 3, 1935. 456,150.

MANUFACTURE OF DERIVATIVES OF HYDROCYANIC ACID.—Imperial Chemical Industries, Ltd. May 3, 1934. 456,151.

ALCOHOL SULPHATION PROCESS.—Carbide and Carbon Chemicals Corporation. May 9, 1934. 456,214.

MANUFACTURE AND PRODUCTION OF DIAMIDES AND IMIDES of dicarboxylic acids.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). May 7, 1935. 456,070.

TEXTILE-PRINTING.—Imperial Chemical Industries, Ltd., R. F. Goldstein, S. T. McQueen, and D. A. W. Fairweather. May 8, 1935. 456,357.

PROCESS FOR THE MANUFACTURE OF VALUABLE POLYMERIC PRODUCTS derived from aromatic vinyl hydrocarbons.—A. Carpmael (I. G. Farbenindustrie.) May 8, 1935. 456,359.

TREATMENT OF HYDROCARBON OILS with selective solvents.—Standard Oil Development Co. July 14, 1934. 456,422.

PRODUCTION OF VALUABLE HYDROCARBONS by the destructive hydrogenation of carbonaceous materials.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). May 15, 1935. 456,371.

ELECTROLYTIC DEPOSITIONS OF LEAD PEROXIDE.—Y. Kato. December 20, 1934. 456,082.

Applications for Patents

(October 29 to November 4 inclusive.)

APPARATUS FOR PURIFYING, ETC., OIL.—R. L. Armstrong. 29589.

DECOLOURISATION, ETC. OF SUGAR-CANE JUICES, ETC.—Sir A. E. Aspinall and F. Hardy. 29573.

PRODUCTION OF GAS BY DRY DISTILLATION.—Azett-Gas-Apparate-Bau Ges. 30064.

PRODUCTION OF SMOKE SCREENS.—B. S. Bernstein. 29477.

MANUFACTURE OF COMPOUNDS OF THE CYCLO-PENTANO-HYDROPHENANTHRENE SERIES.—A. G. Bloxam. (Soc. of Chemical Industry in Basle). 30036.

PRODUCTION OF CHLORIDES of metals of the alkali series.—H. Browning. 29710.

PREPARATION OF CARBON BLACK, ETC.—D. Dulgin and F. B. Jones. 29994.

METHOD, ETC. FOR SEPARATION OF PARAFFIN WAXES, ETC.—Burmah Oil Co., Ltd. 29722.

PROCESS FOR DYEING CELLULOSE.—A. Carpmael (I. G. Farbenindustrie.) 29571.

MANUFACTURE OF UNSATURATED KETONES.—A. Carpmael (I. G. Farbenindustrie.) 29910.

PLASTER OF PARIS COMPOSITIONS.—C. G. F. Cavadine. 29824.

PRODUCTION OF ORGANIC PHOSPHOROUS COMPOUNDS.—Celluloid Corporation. (United States, Nov. 20, '35.) 29897.

CARBONISATION OF COAL AND OIL MIXTURES.—Coal and Allied Industries, Ltd. 29452.

METHOD OF PREPARING SULPHUROUS BATHS.—W. Daniewski. (Poland, Nov. 2, '35.) 29820.

EXTRACTION OF OILS, ETC.—Extractol Process, Ltd. (United States, Nov. 7, '35.) 29827.

EXTRACTION OF OILS, ETC.—Extractol Process, Ltd. (United States, Aug. 6.) 29828.

PRODUCTION OF SUPERPHOSPHATE FERTILISERS, ETC.—L. H. Facer. 29952.

MANUFACTURE OF MAGNESIUM.—D. Gardner. 29631, 29632.

MANUFACTURE OF ALUMINIUM.—D. Gardner. 29633, 29634.

MANUFACTURE OF HIGHLY ACTIVE PLANT-COLLOIDAL METAL COMPOUNDS.—P. Goetze. 3003.

MANUFACTURE OF CHLOROFORM.—J. J. Gray. 29617.

MANUFACTURE OF l-SORBOSE.—W. W. Groves. 29664.

MANUFACTURE OF CONDENSATION PRODUCTS.—W. W. Groves. 29665.

PRODUCTION OF MOLECULAR DIFFUSIBLE GAS SOLUTIONS.—H. H. Heer. (Germany, Nov. 4, '35.) 30042.

EXTRACTION OF BERYLLIUM-HYDRATE from berrylium-bearing pegmatites.—E. Herzog. 29990.

LACQUERS.—I. G. Farbenindustrie. (Germany, Oct. 31, '35.) 29534.

ORGANIC GOLD COMPOUNDS.—I. G. Farbenindustrie. (Germany, Oct. 30, '35.) 29535.

MANUFACTURE OF AROMATIC ARSENIC, ETC. COMPOUNDS.—I. G. Farbenindustrie. (Germany, Nov. 9, '35.) 29536.

PRODUCTION OF HARD CARBIDES.—I. G. Farbenindustrie. (Germany, Feb. 11.) 29831.

MANUFACTURE, ETC. OF AMINO COMPOUNDS.—I. G. Farbenindustrie. 30019.

PROCESS FOR CHLORINATING, ETC. KETONES.—I. G. Farbenindustrie. (Germany, Nov. 5, '35.) 30033.

INSECTICIDES.—I. G. Farbenindustrie. (Germany, Nov. 5, '35.) 30034.

TREATMENT OF EDIBLE FATS, ETC.—Industrial Patents Corporation. (United States, Aug. 12.) 29680, 29681.

APPARATUS FOR THE HYDROGENATION OF UNSATURATED HYDROCARBONS, ETC.—International Hydrogenation Patents Co. 29381.

MANUFACTURE OF RUBBER COMPOSITIONS.—International Latex Processes, Ltd. (Italy, Dec. 3, '35.) 29635.

Chemical and Allied Stocks and Shares

INDUSTRIAL shares continued to attract active interest, but movements in prices were rather irregular owing to profit-taking sales. Nevertheless there were many strong features and in some instances rises on balance for the week have been substantial. Imperial Chemical, which continued to benefit from the House of Lords' decision regarding the company's capital proposals, have moved up further from 42s. 7½d. to 44s., and the deferred shares also made a higher price. Distillers were in request on the belief that unless it is the intention to distribute a bonus sooner or later, a larger dividend is probable. There is already talk in the market of a dividend of 25 per cent. and the shares have risen further from 116s. 3d. to 118s. 3d. Imperial Smelting showed some recovery in price in advance of the annual meeting, but the 2s. shares of British Industrial Plastice reacted from 4s. 1½d. to 3s. 6d. on the absence of an increased dividend. The directors state in their report that owing to competition, profits have not shown as great expansion as in recent years, but they add that steps have been taken to meet the situation and that the outlook for the future has improved. The dividend is maintained at 8 per cent.

Fison, Packard were steadier around 44s. Cooper, McDougall and Robertson were more active with business up to 38s. 9d. on a general realisation that if better conditions are developing in the Argentine and other agricultural countries, improved demand for the company's products is likely to result. General Refractories were active around 32s. on the belief that despite the larger capital ranking, a further increase in dividend is not improbable as fuller benefits should apparently be accruing from the company's more recent acquisitions. The recently issued 5s. shares of International Diatomite were active around 6s. 6d. Goodlass Wall and Lead Industries lost a few pence to 15s. There was good demand reported at Sheffield for Newton Chambers, which changed hands up to 63s. The company has a good dividend record and there are anticipations in the market of an increased distribution for the current year.

Boots were active around 53s. 1½d. the distribution of valuable bonuses by various other companies having drawn increased attention to this company's string balance sheet and the possibility of a bonus of some kind sooner or later. Timothy Whites and Taylors recovered strongly to 36s., awaiting the dividend announcement. British Glues at 9s. 9d. have lost part of last week's rise, but the 8 per cent. preference shares were very firm at 30s. on attention drawn to their participating dividend rights. Salt Union remained steady at 43s. 6d. British Drug Houses were a few pence higher at 41s. 3d. Monsanto Chemicals preferences kept their rise to 22s. 9d. Greeff-Chemicals Holdings at 9s. 1½d. are within 3s. of the price ruling a week ago. Activity in the metal markets continued to attract increased attention to the shares of Amalgamated Metal Corporation and Metal Traders.

Richard Thomas were in request at higher prices on reports that the issue of capital to finance the construction of the company's large new steel works, foreshadowed at the last meeting, may not be proposed. The market realises that if further capital is required other means than an issue of ordinary shares could be adopted, but the disposition is to assume that, particularly as the interim dividend is being increased, a favourable rise in the total dividend is not improbable. Dorman Long were higher on the dividend. Baldwins were steady, it being realised that the debenture redemption proposals enhance prospects of a satisfactory increase in dividend on the ordinary shares.

Wall Paper deferred shares remained around the lower level to which they went recently, the disposition being to await the statements at the meeting and any reference that may then be made as to the outlook for the current year. Pinchin Johnson were again active on talk of a possible bonus distribution and Lewis Berger, International Paint and most other paint shares were very firm. Oil shares were more active on the belief that the interim dividend decisions of "Shell" and Royal Dutch will be forthcoming shortly.

Weekly Prices of British Chemical Products

THERE are no price changes to report in the London chemical markets this week. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—Conditions have not been particularly active on the Manchester chemical market during the past week. Deliveries into consumption against contracts, generally speaking, keep up on a satisfactory level and some increase in activity continues to be reported in the case of the cotton textile trade, which is reacting slightly upon the demand for dyeing and finishing chemicals. There has been a sprinkling of business this week for early delivery and in respect of one or two products for which contract prices have now been arranged there has been some forward buying over next year. Contract prices of a number of other articles are expected to be decided upon towards the end of this week and from now on there will be the customary year-end activity in the arrangement of forward transactions.

GLASGOW.—The Scottish heavy chemical market shows considerable improvement and a great number of prices are being quoted for contracts over the year 1937. Export business has, however, remained limited. Prices continue quite firm at about last week's figures with no important changes to report. The demand for coal tar products has been rather easier, and export business limited. A general steadying effect upon creosote prices has come as a result of the invitation of railway companies to tender for their annual requirements. The fixing of these contracts should be an important factor in determining the market value for some time to come. Available supplies of cresylic and carbolic acids are finding a ready outlet, and smaller quantities of high boiling tar acids have been sold for prompt delivery. Motor benzol has been less active, probably due to a seasonal fall in demand. Crude benzol has changed hands within the price range reported.

General Chemicals

ACETONE.—£62 to £65 per ton; SCOTLAND: £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, in 1 cwt. bags, £28; powdered, in 1 cwt. bags, £29.

ACID, CHROMIC.—9¼d. per lb., less 2½%; d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 11¾d. to 1s. SCOTLAND: B.P. crystals, 1s. per lb., less 5%.

ACID, CRESYLIC.—97/99%, 3s. 2d. to 3s. 3d. per gal.; pale, 98%, 3s. 1d. to 3s. 2d.; dark, 2s. 6d. to 2s. 7d.; 99/100%, refined, 3s. 7d. to 3s. 9d. per gal. MANCHESTER: 99/100%, pale, 3s. 8d.

ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50: pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. SCOTLAND: £2 9s. 6d. per cwt. in casks. MANCHESTER: £49 to £54 10s. per ton ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 11¾d. less 5%. MANCHESTER: 1s. per lb.

ALUM.—SCOTLAND: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19 (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £6 19s. per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish £17 10s. ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BARYTES.—£6 to £7 10s. per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.a. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton in casks, special terms for contracts. SCOTLAND: £9.

BORAX COMMERCIAL.—Granulated, £14 10s. per ton; crystal £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots. SCOTLAND: Granulated, £14 10s. per ton in 1 cwt. bags, carriage paid.

CADMIUM SULPHIDE.—4s. 1d. to 4s. 3d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. SCOTLAND: 70/75% solid, £5 10s. per ton net ex store.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¾d. per lb. LONDON: 4¼d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2¾d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s per cwt. SCOTLAND: £3 19s. 6d. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 5s. 1d. per lb.

LAMPBLACK.—£23 to £24 per ton.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £35, brown, £34.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £34 per ton less 2½%, carriage paid, for 2-ton lots.

LEAD, WHITE.—SCOTLAND: £40 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 to £16 5s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PARAFFIN WAX.—SCOTLAND: 3⅝d. per lb.

PHENOL.—6⅜d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 4¼d. per lb. MANCHESTER: £38 10s. per ton.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P. 4s. 3d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. Crystals, 8¼d. MANCHESTER: B.P. 10½d. to 11¼d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 7½d. to 8d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 7d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £17 15s. per ton net ex store.

Sodium Bicarbonate.—Refined spot, £10 10s. per ton d/d station in bags. Scotland: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. Manchester: £10 10s.

Sodium Bichromate.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. London: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. Manchester: 4d. per lb. Scotland: 4d., less 5% carriage paid.

Sodium Bisulphite Powder.—60/62%. £20 per ton d/d 1 cwt. iron drums for home trade.

Sodium Carbonate, Monohydrate.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, Scotland: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

Sodium Chlorate.—£29 per ton. Scotland: £1 10s. per cwt.

Sodium Chromate.—4d. per lb. d/d U.K.

Sodium Hyposulphite.—Scotland: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. Manchester: Commercial, £10; photographic, £14 10s.

Sodium Iodide.—B.P., 6s. per lb.

Sodium Metasilicate.—£14 per ton, d/d U.K. in cwt. bags.

Sodium Nitrite.—London: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

Sodium Perborate.—10%, 9¼d. per lb. d/d in 1-cwt. drums. London: 10d. per lb.

Sodium Phosphate.—£13 per ton.

Sodium Prussiate.—London: 5d. to 5¼d. per lb. Scotland: 5d. to 5¾d. ex store. Manchester: 4½d. to 4¾d.

Sodium Silicate.—140° Tw. Spot, £8 per ton. Scotland: £8 10s.

Sodium Sulphate (Glauber Salts).—£4 2s. 6d. per ton d/d Scotland: English material, £3 15s.

Sodium Sulphate (Salt Cake).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. Scotland: Ground quality, £3 5s. per ton d/d. Manchester: £3 2s. 6d. to £3 5s.

Sodium Sulphide.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. Scotland: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. Manchester: Concentrated solid, 60/62%, £11; commercial, £8.

Sodium Sulphite.—Pea crystals, spot, £13 5s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

Sulphate of Copper.—Manchester: £15 per ton f.o.b. Scotland: £17 15s. per ton less 5%.

Sulphur.—£9 to £9 5s. per ton. Scotland: £8 to £9.

Sulphur Chloride.—5d. to 7d. per lb., according to quality.

Sulphur Precip.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

Vermilion.—Pale or deep, 5s. 1d. per lb. in 1-cwt. lots.

Zinc Chloride.—Scotland: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

Zinc Sulphate.—London: £12 per ton. Scotland: £10 10s.

Zinc Sulphide.—10d. to 11d. per lb.

Nitrogen Fertilisers

Sulphate of Ammonia.—Neutral quality, basis 20.6 per cent. nitrogen, delivered in 6-ton lots to farmer's nearest station, November, £6 19s. per ton; December, £7 0s. 6d. per ton; January, 1937, £7 2s. per ton; February, £7 3s. 6d. per ton; March to June, £7 5s. per ton.

Calcium Cyanamide.—November, £6 18s. 9d. per ton; December, £7 per ton; January, 1937, £7 1s. 3d. per ton; February, £7 3s. 6d. per ton; March, £7 3s. 9d. per ton; April to June, £7 5s. per ton, carriage paid to any railway station in Great Britain in lots of four tons and over.

Nitro-Chalk.—£7 5s. per ton for delivery to end of June, 1937.

Nitrate of Soda.—£7 12s. 6d. per ton for delivery up to end of June, 1937.

Concentrated Complete Fertilisers.—£10 12s. to £11 1s. per ton for delivery up to end of June, 1937, delivered in 6-ton lots to farmer's nearest station.

Ammonium Phosphate Fertilisers.—£10 5s. to £13 15s. per ton for delivery up to end of June, 1937, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

Acid, Cresylic.—97/99%, 3s. 2d. to 3s. 3d. per gal.; 99/100%, 3s. 6d. to 4s. per gal., according to specification; pale 99%, 3s. 4d. to 3s. 5d.; dark, 2s. 9d. to 2s. 10d. Glasgow: Pale, 99/100%, 3s. to 3s. 6d. per gal.; pale, 97/99%, 2s. 6d. to 2s. 9d.; dark, 97/99%, 2s. 5d. to 2s. 8d.; high boiling acids, 1s. 8d. to 2s.; American specification, 2s. 9d. to 3s.

Acid, Carbolic.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 2s. 7d. to 2s. 9d. per gal. Manchester: Crystals, 6¾d. to 7d. per lb.; crude, 2s. 8d. per gal. Glasgow: Crude, 60's, 2s. 6d. to 2s. 9d. per gal.; distilled, 60's, 2s. 9d. to 3s. 3d.

Benzol.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7¾d. London: Motor, 1s. 3½d. Glasgow: Crude, 9d. to 10d. per gal.; motor, 1s. 2d. to 1s. 3d.

Creosote.—B.S.I. Specification standard, 5¾d. per gal. f.o.r. Home, 3¾d. d/d. London: 4½d. f.o.r. North: 5d. London. Manchester: 4¾d. to 5½d. Glasgow: B.S.I. Specification 5d. to 5½d. per gal.; washed oil, 4¾d. to 4¾d.; lower sp. gr. oils, 4¾d. to 5d.

Naphtha.—Solvent, 90/160%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 7d.; 90%, 1s. to 1s. 2d. London: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. Glasgow Crude, 5½d. to 6d. per gal.; 90% 160, 1s. 4½d. to 1s. 5½d.; 90% 190, 1s. to 1s. 1d.

Naphthalene.—Crude, whizzed or hot pressed, £12 to £13 per ton; purified crystals, £20 per ton in 2-cwt. bags. London: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. Glasgow: Fire lighter, crude, £7 to £8 per ton (bags free).

Pyridine.—90/140%, 7s. 6d. to 9s. per gal.; 90/180, 2s. 3d. Glasgow: 90% 140, 7s. to 8s. per gal.; 90% 160, 5s. to 6s.; 90% 180, 2s. 6d.

Toluol.—90%, 2s. per gal.; pure, 2s. 4d. Glasgow: 90%, 120, 1s. 10d. to 1s. 11d. per gal.

Pitch.—Medium, soft, 35s. per ton, in bulk at makers' works. Manchester: 32s. 6d. f.o.b., East Coast. Glasgow: f.o.b. Glasgow, 30s. to 35s. per ton; in bulk for home trade, 32s. 6d.

Xylol.—Commercial, 2s. 1d. per gal.; pure, 2s. 3d. Glasgow: Commercial, 1s. 11d. to 2s. per gal.

Wood Distillation Products

Acetate of Lime.—Brown, £8 10s. to £9 per ton; grey, £10 10s. to £11. Liquor, brown, 30° Tw., 6d. to 8d. per gal. Manchester: Brown, £9 10s.; grey, £11 10s.

Charcoal.—£5 5s. to £10 per ton, according to grade and locality.

Methyl Acetone.—40-50%, £45 to £48 per ton.

Wood Creosote.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.

Wood, Naphtha, Miscible.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.

Wood Tar.—£2 to £3 per ton.

Intermediates and Dyes

Acid, Benzoic, 1914 B.P. (ex toluol).—1s. 9¼d. per lb. d/d buyer's works.

Acid, Gamma.—Spot, 4s. per lb. 100% d/d buyer's works.

Acid, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

Acid Naphthionic.—1s. 8d. per lb.

Acid, Neville and Winther.—Spot, 3s. per lb. 100%.

Acid, Sulphanilic.—Spot, 8d. per lb. 100%, d/d buyer's works

Aniline Oil.—Spot, 8d. per lb., drums extra, d/d buyer's works

Aniline Salts.—Spot, 8d. per lb. d/d buyer's works, casks free

Benzidine, HCl.—2s. 5d. per lb., 100% as base, in casks.

***o*-Cresol 30/31° C.**—6½d. to 7½d. per lb. in 1-ton lots.

***p*-Cresol 34-5° C.**—1s. 7d. to 1s. 8d. per lb. in ton lots.

***m*-Cresol 98/100%.**—1s. 8d. to 1s. 9d. per lb. in ton lots.

Dichloraniline.—1s. 11½d. to 2s. 3d. per lb.

Dimethylaniline.—Spot, 1s. 6d. per lb., package extra.

Dinitrobenzene.—8d. per lb.

Dinitrotoluene.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

Dinitrochlorbenzene, Solid.—£72 per ton.

Diphenylamine.—Spot, 2s. per lb., d/d buyer's works.

α-Naphthol.—Spot, 2s. 4d. per lb., d/d buyer's works

β-Naphthol.—In bags, £88 15s. per ton; in casks, £89 15s.

α-Naphthylamine.—Lumps, 1s. per lb.; ground, 1s. 0½d.

β-Naphthylamine.—Spot, 2s. 9d. per lb., d/d buyer's works in casks.

***o*-Nitraniline.**—3s. 11d. per lb.

***m*-Nitraniline.**—Spot, 2s. 7d. per lb., d/d buyer's works.

Latest Oil Prices

London, Nov. 18.—**Linseed Oil** was firm. Spot, £27 10s. per ton (small quantities); Dec. and Jan.-April, £25 2s. 6d.; May-Aug., £25 5s.; Sept.-Dec., £25 7s. 6d., naked. **Soya Bean Oil** was firm. Oriental (bulk), ex tank, spot, Rotterdam, £25 per ton. **Rape Oil** was quiet. Crude, extracted, £33 10s. per ton; technical, refined, £34 10s., naked, ex wharf. **Cotton Oil** was firmer. Egyptian, crude, £27 per ton; refined common edible, £30; and deodorised, £32, naked, ex mill (small lots £1 10s. extra). **Turpentine** was again easy. American, spot, 39s. 9d. per cwt.

Hull.—**Linseed Oil.**—Spot, quoted £25 10s. per ton; Nov.-Dec., £25 2s. 6d.; Jan.-April and May-Aug., £25. **Cotton Oil.**—Egyptian crude, spot, £27 10s.; edible, refined, spot, £29 10s.; technical, spot, £29 10s.; dedorised, £31 10s., naked. **Palm Kernel Oil.**—Crude, f.m.q., spot, £28 10s., naked. **Groundnut Oil.**—Extracted, spot, £34; deodorised, £37. **Rape Oil.**—Extracted, spot, £33; refined, £34. **Soya Oil.**—Extracted, spot, £28 10s.; deodorised, £31 10s. per ton. **Cod Oil.**—F.o.r. or f.a.s., 25s. per cwt., in barrels. **Castor Oil.**—Pharmaceutical, 43s. 6d. per cwt.; first, 38s. 6d.; second, 36s. 6d. **Turpentine.**—American, spot, 42s. per cwt.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ANGLO-SCOTTISH PETROLEUM CO., LTD., London, S.E. (M., 21/11/36.) November 4, £500 debenture to T. Thornycroft, Basingstoke; general charge. *Nil. September 28, 1936.

CASEIN (INDUSTRIES), LTD., London, S.W. (M., 21/11/36.) November 7, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on 102 Sheepcote Lane, Battersea. *Nil. October 11, 1935.

MIDWAY CHEMICAL CO., LTD., Slough. (M., 21/11/36.) November 9, series of £1,500 debentures, present issue £300; general charge. *Nil. December 31, 1935.

NATURAL THERAPEUTICS, LTD., Kingswood. (M., 21/11/36.) November 7, £300 debentures, part of amount already registered. *£3,800 debentures. September 24, 1936.

SUDOL PRODUCTS, LTD., London, N., chemical manufacturers. (M., 21/11/36.) November 9, £300 debenture and 2½ per cent. premium, to Elect Property Co., Ltd.; general charge.

Satisfactions

LAFARGE ALUMINOUS CEMENT CO., LTD., London, W.C. (M.S., 21/11/36.) Satisfaction November 6, of debenture registered. July 17, 1936.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

PLIMSOLINE PRODUCTS, LTD., 140 Falkland Road, Hornsey, manufacturing chemists. (C.C., 21/11/36.) £16 4s. 8d. October 14.

TALBOT, JNO., 8 Mayfair Avenue, Cranbrook Park, Ilford. (C.C., 21/11/36.) £13 1s. 0d. October 6.

Companies Winding-up Voluntarily

THE SCOTTISH PEAT COMPOUND AND CHEMICAL CO., LTD. By special resolution, October 31, 1936. Mr. Eric C. Smith, chartered accountant, 44 Brazennose Street, Manchester, appointed liquidator.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—The Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1, invites tenders for 21,000 gal. Cresol, saponified; not b.p. or lysol. Samples required. Tenders due, December 1. Forms of tender obtainable from the above at a fee (which will not be returned) of 5s. for each schedule.

Canada.—A Toronto firm of dealers in produce and bakers and confectioners, etc., supplies wishes to secure the representation of a United Kingdom manufacturer of pure food gelatine for the whole of Canada. (Ref. No. 466.)

South Africa.—The British Trade Commissioner at Johannesburg reports that the Public Works Department is calling for tenders, to be presented in South Africa by December 4, 1936, for the supply of a deep well pump head, steel pump rods, electric motor, etc. (Ref. T.Y. 2160.)

South Africa.—The Public Works Department, Pretoria, is calling for tenders, to be presented in South Africa by December 4, 1936, for the supply of two electrically-driven centrifugal sewage pumps, complete with motors and switchgear. (Ref. T.Y. 2157); also for the supply of two turbine pumps complete with motors and switchgear, two 3 in. C.I. flanged valves, two 3 in. C.I. reflux valves, two C.I. air bottles and two 4 in. C.I. foot vales. (Ref. T.Y. 2159.)

South Africa.—The South African Public Works Department is calling for tenders, to be presented in Pretoria by January 8, 1937, for the supply of one washing machine, one hydro-extractor, two laundry wagons, together with shafting, etc., required by the Pretoria Leper Institute. (Ref. T.Y. 2165.); also for the supply of two refrigerating units for the Elsenberg Agricultural College Dairy, Cape Province. (Ref. T.Y. 2164.)

New Companies Registered

Williams and Houghton, Ltd., 24 Mill Lane, West Derby, Liverpool, 12.—Registered November 3. Nominal capital £500. Pharmaceutical, manufacturing, dispensing and analytical chemists, photographic chemists, opticians, druggists, etc. Directors: John H. Williams, Leslie D. Houghton.

Shefford Soap Company, Ltd., 42 Cornhill, E.C.3.—Registered October 31. Nominal capital £100. Manufacturers of and dealers in chemicals, chemical products and by-products, soaps, etc. Subscribers: Adolf Gerson, Wm. E. Baldwin, John S. Waters.

Sonnenbergs, Ltd., 80a Coleman Street, E.C.—Registered October 31. Nominal capital £100. Importers and exporters of and dealers in vegetables and animal produce, minerals, chemicals, metals, etc. Directors: John W. Clough, and Bertram H. Fleming.

Thomas Goodhew's Sons, Ltd., College Works, Bridge Street, Rochdale.—Registered November 2. Nominal capital, £2,000. To acquire the business of Thomas Goodhew's Sons carried on by Thos. Goodhew at College Works, Bridge Street, Rochdale, and to carry on the business of manufacturers of and dealers in chemicals, gases, drugs, oils, medicines, etc. Directors: Thos. J. Goodhew, Mrs. Mary A. Goodhew and Alice Goodhew.

Forthcoming Events

LONDON.

Nov. 25.—Institute of Fuel. "The Analysis of Flue Gases in the Locomotive Boiler by Electrical Conductivity Metres." V. Binns and S. Bairstow. 6 p.m. The Meeting Room of the Chemical Society, Burlington House, Piccadilly, London.

Nov. 25.—Institute of Metals (London Local Section). Supper-Dance. 7.30 p.m. Thames House, Millbank, London.

Nov. 27.—Physical Society. Ordinary Meeting. 5 p.m. Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London.

Nov. 27.—Physical Society. Ordinary Meeting .5 p.m. Imperial p.m. Waldorf Hotel, Aldwych, London.

Nov. 29.—British Association of Chemists. Annual General Meeting. 3 p.m. Waldorf Hotel, Aldwych, London.

BELFAST.

Nov. 28.—Institute of Chemistry (Belfast and District Section). Annual Dinner. Grand Central Hotel, Belfast.

GLASGOW.

Nov. 26.—Institute of Vitreous Enamellers (Scottish Section). "Cast Iron for Enamelling Purposes." G. M. Logan. 7.30 p.m. Royal Technical College, Glasgow.

HULL.

Nov. 27.—Hull Chemical and Engineering Society. Annual Dinner and Dance. 7.30 p.m. Powolny's, King Edward Street, Hull.

LEEDS.

Nov. 26.—Chemical Society (Leeds Section). "The Biological Breakdown of Carbohydrates." Dr. H. A. Krebs. 7 p.m. Lecture Theatre of the new Chemistry Building, The University, Leeds.

LIVERPOOL.

Nov. 25.—British Association of Chemists (Liverpool Section). Section Meeting. 7.30 p.m. Victoria Hotel, Liverpool.

MANCHESTER.

Nov. 24.—Chemical Society. (Manchester Section). Society of Chemical Industry. (Manchester Section). Manchester University Chemical Society. "Chemical Detection of Artificially Produced Elements." Professor F. Paneth. 7 p.m. Constitutional Club, St. Ann's Street, Manchester.

Nov. 27.—Manchester Literary and Philosophical Society. (Chemical Section). "Motor Lubrication and Lubricants." J. E. Haslam. 7 p.m. 36 George Street, Manchester.

NEWCASTLE-UPON-TYNE.

Nov. 26.—Coke Oven Managers' Association. "High Temperature Coke and the Open Grate." Dr. J. Taylor. Newcastle-upon-Tyne.

Nov. 27.—Institute of Metals. (North-East Coast Local Section). "Refractories." J. W. Mellor. 7.30 p.m. Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-upon-Tyne.